



SHARK.

And the shark by James C. Smith, London.

THE
NATURALIST'S CABINET
OR
Interesting Sketches
OF
Animal History
VOL. 5.



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THE
NATURALIST'S
CABINET:

Containing
INTERESTING SKETCHES
OF
ANIMAL HISTORY;
Illustrative of the
NATURES, DISPOSITIONS, MANNERS, AND HABITS,
OF ALL THE MOST REMARKABLE
Quadrupeds, Birds, Fishes, Amphibia, Reptiles, &c.
IN THE KNOWN WORLD.

REGULARLY ARRANGED, AND ENRICHED WITH NUMEROUS
BEAUTIFUL DESCRIPTIVE ENGRAVINGS.

"Who can this field of miracles survey,
And not with *Galen* all in rapture say,
Behold a *God*, adore him, and obey?"

BLACKMORE.

IN SIX VOLUMES.
VOL. V.

BY THE
REV. THOMAS SMITH,
Editor of a New and Improved Edition of Whiston's Josephus, &c. &c.

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STAINES

1884-1885

THE STAINES

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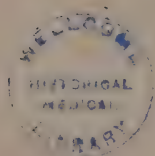
THE STAINES

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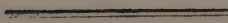
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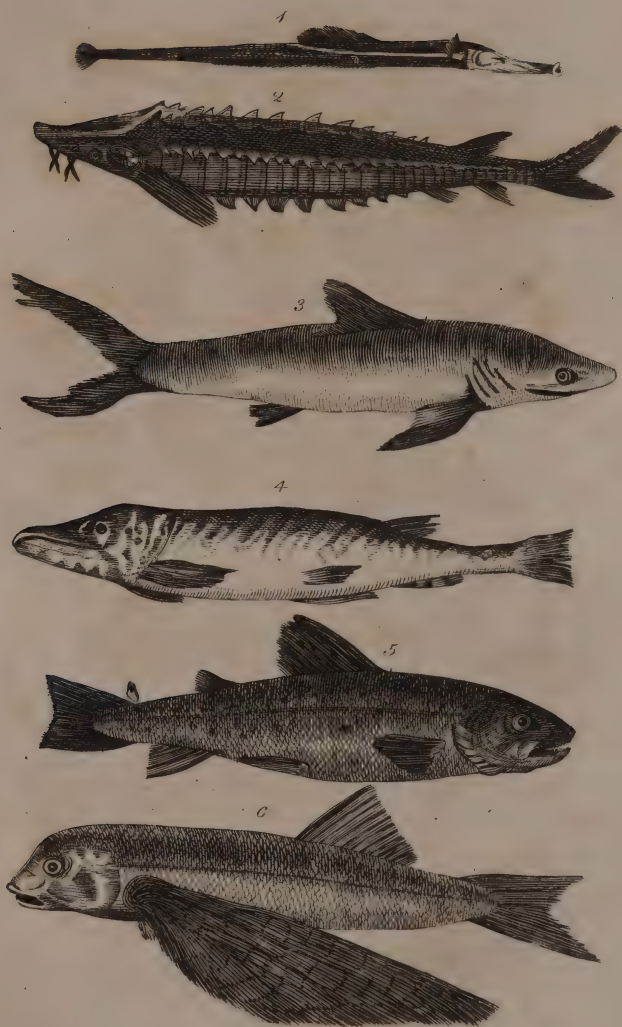
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FISH.

Del. Wm. A. G. Jones. Copper. London.

THE
Naturalist's Cabinet.

CHAP. I.

" . . . The sounds and seas, each creek and bay
With fry innumerable swarm, and shoals
Of fish, that, with their fins and shining scales
Glide under the green wave."

MILTON.

OF FISH IN GENERAL.

Introduction.

IT has been proved from experience, that the very depths of the immense ocean contains myriads of creatures, to whose very form we are almost strangers, and of whose dispositions and manners we are still more ignorant. In their construction, however, modes of life, and general design, these creatures are as truly wonderful as the inhabitants of either the land or air.

The structure of fish, and their conformation to the element in which they are to live, are eminent proofs of divine wisdom. Most of them have the same external form, sharp at each end,

Rapid motion of fish.

and swelling in the middle, by which configuration they are enabled to traverse the watery element with greater ease and swiftness. From their shape men have taken the idea of those vessels which are intended to sail with the greatest speed; but the progress of the swiftest sailing ship, with the advantage of a favourable wind, is far inferior to that of fish. Ten or twelve miles an hour is no small degree of rapidity in the sailing of a ship; yet any of the larger species of the watery tribe would soon overtake her, play round as if she did not move, and even advance considerably before her.

The motion of fish being different from that of fowls or quadrupeds, they require neither anterior nor posterior extremities, but are provided with machines, consisting of a number of elastic beams, connected by firm membranes, and with a tail of the same texture. Their tails are so framed as to contract to a narrow space when drawn together to either side, and to expand when drawn to a straight line with their bodies: thus, by the assistance of this broad tail, and the fins on their sides, they make their progression much in the same way as a boat with oars on its sides, and a rudder at its stem.

The fins of fish are denominated from their situations. The pectoral fins are placed at a little distance behind the opening of the gills, and are large and strong, and serve as well to balance the body as to assist the motion of the fish. The

Utility of the fins.

ventral fins are placed towards the lower part of the body, under the belly, and serve chiefly to raise or depress the fish in the water. The dorsal fins are situate on the ridge of the back, and are very large in flat fish: their use, like the pectoral ones, is to keep the body in equilibrio, as well as to contribute to its progressive motion. The anal fins are placed between the vent and the tail, enabling the fish to keep an upright position.

In some the fins are much more numerous than in others; a fish completely fitted for swimming with rapidity is generally furnished with two pair on the sides, and three single ones, two above and one below; yet it does not always happen that the fish which has the greatest number of fins is the swiftest swimmer. The shark is thought to be one of the swiftest, and yet has no fins on his belly, while the haddock seems more completely fitted for motion, and yet is not near so swift a swimmer.

By means of their fins, the bodies of the fish are duly poised: were these fins cut off, the fish can still swim, but will turn upon its sides or its back, without being able to keep itself in an erect posture as before. When the fish is in a state of repose, it spreads all its fins, and seems to rest upon the pectoral ones, or those near the gills, and the ventral, or belly fins, near the bottom; it has the power of folding up its pectoral fins, and by that means inclining to the side on

The tail a chief instrument of motion.

which the fin is folded. To produce a retrograde motion, the pectoral fins are struck in a contrary direction. If the creature desire to turn, a blow from the tail sends it about in an instant; but if the tail strike both ways, then the motion is progressive. And it is observable, that some fish that have no fins at all, such as lobsters, dart forward with prodigious rapidity by means of their tail, which is now found to be the instrument of progressive motion in all the aquatic species; and when the tail is cut off, the fish gives itself up entirely to the impulse of the water, being deprived of all motion.

A slimy glutinous matter, with which fish are in general furnished, defends their bodies from the immediate contact of the surrounding fluid, and which, likewise, in all probability, assists their motion through the water. Beneath this, in many kinds, is found a strong covering of scales, that like a coat of mail, defends it yet more powerfully; and under that, before we come to the muscular parts of the body lies an oily substance, which also tends to preserve the requisite warmth and vigor. The scales of this cuticle are laid on one another like tiles on a building, and the use of which is analogous to the hair, wool, feathers, &c. of other animals, and below which their proper cuticula and cutis may be discovered.

In order to prove whether fish which are formed for living entirely in the water, could

Experiments by Mr. Hawkshee.

subsist without air, Mr. Hawkshee made several experiments, which are recorded in the philosophical transactions. The fish he employed were gudgeons: a species that are very lively in the water, and can live a considerable time out of it. Three of them were put into a glass vessel, with about three pints of fresh water, which was designed as a standard to compare the others by. Into another glass, to a like quantity of water, were put three more gudgeons, and thus the water filled the glass to the very brim. Upon this he screwed down a brass plate with a leather below to prevent any communication between the water and the external air, and, that it might the better resemble a pond frozen over, he suffered as little air as possible to remain on the surface of the water. A third glass had the same quantity of water put in it, which, first by boiling, and then by continuing it a whole night in *vacuo*, was purged of its air as well as possible; and into this also were put three gudgeons. In about half an hour, the fish in the water from whence the air had been exhausted, began to discover some signs of uneasiness, by a more than ordinary motion in their mouths and gills. Those that had no communication with the external air, would at this time also frequently ascend to the top, and suddenly swim down again: and in this state they continued for a considerable time, without any sensible alteration. About five hours after this observa-

Supposed utility of the gills.

tion, the fish in the exhausted water were not so active as before, upon shaking the glass which contained them. In three hours more, the included fish lay all at the bottom of the glass with their bellies upwards; nor could they be made to shake their fins or tail by any motion given to the glass. They had a motion with their mouths, however, which shewed that they were not perfectly dead. On uncovering the vessel which contained them, they revived in two or three hours, and were perfectly well next morning; at which time those in the exhausted water were also recovered. The vessel containing these last being put under the receiver of an air-pump; and the air exhausted, they all instantly died. They continued at top, while the air remained exhausted, but sunk to the bottom on the admission of the atmosphere.

It is imagined that the gills of fish are intended for an operation somewhat similar to that of the lungs in other animals; their motion is very analogous to our breathing; yet the use of air to these creatures is difficult to be assigned; and the means of obtaining what they want is not easily to be accounted for, or rendered intelligible. The general explanation of this phenomenon is, that the fish first take a quantity of water into their mouth, which is driven into the gills; these close and keep the water which is swallowed from returning by the mouth, while the bony covering of the gills prevents it from going

Remarks on the air-bladder.

through them, until the animal has drawn the proper quantity of air from it; then the bony covers open, and give it a free passage, by which means also the gills are again opened, and admit a fresh quantity of water. If the fish be prevented from the free play of its gills, it soon falls into convulsions, and expires.

Notwithstanding this plausible explanation of the respiration of fish, it still remains a difficulty not easy to be solved, What is done with this air? There seems to be no receptacle for containing it, except the air-bladder or swim, which many modern philosophers are of opinion is only to enable the fish to rise or sink at pleasure, and not destined to answer any vital purpose.

It should be observed that the air-bladder is a vesicle found in the bodies of all spinous, or bony fish, though not in those of the cartilaginous or cetaceous kind, situated towards the back of the fish, opening to the maw or gullet, and composed of one, two, or three divisions. It is thought that the animal possesses a power of distending or contracting this bladder, and of consequence becoming specifically lighter or heavier than the fluid in which it swims, and thence to rise to the top, or sink to the bottom of the water at pleasure; and that such is its use, seems deducible from the following experiment:—A carp being placed in an air-pump, and the air exhausted, the fish soon swelled to such a degree that his eyes started from his head, and the bladder burst by

Opinion of ancient philosophers.

its expansion. The carp continued to live on being thrown into water, but was unable afterwards to rise to the top. The same circumstances are consequent upon any prick or wound of the bladder by which the air may escape; for in such cases the fish continues to crawl at the bottom. And such animals as river cray-fish, oysters, lobsters, crabs, &c. that never quit the bottom of the water, are found destitute of any air-bladder.

Ancient philosophers have in general entertained an opinion, that this vesicle does not merely serve for the purpose of varying the specific gravity of fish, but for some purposes essentially necessary to life. Dr. Priestley also conjectures, that they may serve some other intentions in the animal economy, besides that of the raising or depressing of the fish.

The most conclusive of the several arguments on this side the question is, that all the cartilaginous kind of fish want air-bladders, and yet they rise to the top, or sink to the bottom without any difficulty; and also, that though most of the eel-kind have air-bladders yet they cannot raise themselves in the water without great difficulty.

Some interesting facts relative to this subject of the air or swimming-bladder, have been communicated by Dr. Munro. This gentleman says "It has long been known that in the flat fish there is no swimming-bladder and in a few long-

Facts communicated by Dr. Munro.

shaped fish, as in the mackerel, he has also found it wanting. It is likewise known, that in many fish the air-bag communicates by a duct with the *œsophagus*."

On examining this matter, he found in a sturgeon a round hole, nearly an inch in diameter in the upper and back part of the stomach, by which it communicates with a very large air-bag. In the salmon, he found a hole so large as to admit readily the largest size goose-quill, leading directly through the coats of the *œsophagus* into the air-bag; and if, as in the carp, there are two air-bags, the duct leads to the posterior bag, from which there is a passage into the anterior. From these circumstances he concludes, that the air found in the swimming bladder, passes into it through the above-mentioned ducts, and they seem well suited for this purpose; for, as in the common horizontal situation of the fish, their beginning is at the upper part of the stomach, it is easy to conceive that the air which they take in at their mouth, when they ascend, or that which may by some more latent process be disengaged from the water, is applied to the ducts; and that the fish, by an instinct of nature, distinguishes the irritation of air from that of water, and propels the air into the air-bag, but excludes the water. But in the cod and haddock, though the air-bag is very large, and its sides remarkably strong, yet the doctor was not able to discover any communication of it with the mouth, *œso-*

Observations by Dr. Munro.

phagus, stomach, or intestines. The air-bag was not enlarged by blowing into the alimentary canal, nor could it be emptied without bursting it. Further, on the inner side of the air-bag of the cod, haddock, &c. was found a red-coloured organ, the surface of which is very extensive, composed of a vast number of leaves or membranes doubled; but in those fish where the air-bag communicates with the alimentary canal, this red body is either very small and simple in its structure, as in the conger-eel, or entirely wanting, as in the sturgeon, salmon, carp, &c. Hence, he thinks it reasonable to suppose, that the air may be secreted from this red body, somewhat in the same way it seems to be secreted into the swimming-bladders of aquatic plants, or perhaps into the air-bag of the egg of a bird as the chick grows. Many naturalists, however, may be of opinion, that the cod, haddock, &c. has an air-duct, which has yet escaped observation.

Dr. Munro, in all the fish which fell under his dissection, found the heart to consist of but one ventricle; and that from the latter one artery is sent out, which is entirely spent on the gills. That from the gills, therefore, the returning blood passes to all the other parts of the body, without the intervention of a second auricle, as in man. From his observations and experiments, the doctor concludes, that the circulation of the blood being carried on in the cartilaginous

Remarks on their sense of feeling.

fish in the same manner as the cetaceous and bony, and the whole mass of blood passing through their gills, they must breathe, or they cannot possess the *pulmo anbutarius*, which naturalists have assigned to them.

This gentleman, from the circumstance of very large and numerous lymphatics being dispersed upon the gills of the scales, and the additional one that fish soon die when put into water from which the air has been extracted, and yet that such water is capable of washing off exhaled matter from the gills, and of taking up phlogiston readily, is led to suppose that the gills, or lungs not only discharge hurtful matter, but serve also to take in from the air, which is mixed with the water somewhat necessary for life, the precise nature of which has not as yet been ascertained by any experiments.

The aquatic race of beings have in general been placed in a very inferior scale of importance, on the score of animal faculties, to either quadrupeds or birds. Their sense of feeling, some think, must be very obscure, on account of the scaly coat of mail in which they are wrapped; but in reply it may be urged, that even these scales may be endued with as great or nice a power of sensation as can be imagined, for the sense of feeling is not properly connected with softness in any organ, more than with hardness in it.

With regard to smelling, a similar argument may be used; indeed, how smells can be propagated in water cannot be proved, but that is by no means a proof that they are not so; on the contrary, as water is found to be capable of absorbing putrid effluvia from the air, nothing is more probable than that these putrid effluvia, when mixed with the water, may affect the olfactory organs of fish, as well as they affect ours when mixed with the air. But this idea is carried farther by a very eminent naturalist, who asserts, that, "The olfactory organ in fish is large, and they have a power of dilating and contracting the passage as occasion requires. It is chiefly by their acute smell that they discover their food; and their sight appears to be of less use than that sensation in searching for their nourishment. If a fresh worm be thrown into the water, a fish shall distinguish it at a considerable distance; and that this is not alone by the eye is plain, from observing, that after the same worm has been a considerable time in the water, and lost its smell, no fish will come near it; but if the worm be now taken out, and a few small incisions made into it, in order to transmit fresh effluvia, the former effect will take place. For it is supposed that had the creatures discovered the bait with their eyes they would have come equally to it in both cases."

Smell being the chief means whereby fish discover their food, they consequently allow them-

On their senses of touching and taste.

selves to be carried down with the, stream that they may leisurely re-ascend against the current of the water; thus the-odoriferous particles swimming in that medium being applied more forcibly to their olfactory organ, produce a stronger sensation.

Some naturalists have also supposed that fish are incapable of distinguishing tastes. The palate of most, they say, is hard and bony, consequently incapable of the powers of relishing different substances; and, accordingly, the voracious part of these animals have often been observed to swallow the fisherman's plummet instead of the bait. Indeed, no voracious animals seem to be endued with much sensibility in this respect, nor would it be probably consistent with that way of promiscuously devouring every creature that comes within its reach, without which they would not be able to subsist; though certainly the other kinds are as well able to distinguish their proper food from what is improper, as other animals. With respect to those senses of touching and taste, there can be little room for remark: in all fish, however, external openings for smell are very evident, generally on each side in the osseous fish, and which on each side of the head lead to a complex organ, the surface of which is of considerable extent, and upon a pair of large or olfactory nerves terminate. "In some fish, as the haddock, the olfac-

 Fish's brains—Acute sight.

tory nerve," says Dr. Munro, "in its course between the head and nose, passes through a cineritious ball, resembling the cineritious or ashes-like matter connected in our body to the olfactory nerve within the cranium: consequently, that there can be no doubt that they enjoy the sense of smelling: but there is great reason to believe, that suited to their surrounding element, they are much more sensible of odorous bodies dissolved in water, and applied by its medium, than we should be, if the application of the object was to be made to our organs of smell by the same medium."

The fish's brains are sensibly smaller in proportion to their bodies than in quadrupeds or birds; yet the nerves are as large, in proportion to the several organs, as in those two classes. There is found in fish the like principal division into brain and cerebellum; and these are hollow, and have ventricles within them.

Daily instances occur to prove that fish have a very acute sight, not only of objects in the water, but also of those in the air: their jumping out of the water to catch flies is an abundant proof of this; and they will continue to do this in a fine summer evening, even after it is so dark that mortal eyes cannot distinguish the objects of their search.

It is remarked by Dr. Monro (whose experiments and observations tend to establish the perfection of sight in fish) that the humours of the

eyes of these creatures are proportionally in greater quantity, or much larger than those of animals living in air; the eye of the cod being nearly of the same weight and depth, and its axis of the same length as the eye of the ox. The primary use of the almost completely spherical figure of the crystalline lens in fish, or great convexity, especially of the anterior part of their lens, which this gentleman found to project in the cod about seven-fortieths of an inch beyond the iris, is to take a large field of the objects around them, which was particularly necessary, as the motion of their neck is inconsiderable.

Four chief circumstances occur in order to enable these aquatic animals to collect into a focus on the retina, with the same length of the axis of the eye as in the quadruped, the rays of lights coming from the dense medium of the water; viz.

1st, Their crystalline lens is more convex, or composed of portions of smaller spheres than in land animals.

2dly, Their crystalline lens is, in corresponding parts, much more dense than in animals which live in air.

3dly, The lens in fish possesses power of refracting light far beyond what has been calculated by authors, who have proceeded on the supposition that powers were proportioned nearly to its specific gravity.

And, 4thly, The vitreous humour of fish being

Observations on the hearing of fish.

lighter than that of land animals, the rays of light issuing from their lens will be refracted in a greater degree, or brought sooner to a focus.

Some naturalists have also imagined that fish are totally destitute of hearing; but, on the other hand, it is urged, that when kept in a pond, they may be made to answer at the call of a whistle, or the ringing of a bell; that they appear terrified, and sink to the bottom of the water upon any sudden noise, as thunder, or the firing of guns. Most of the ancients were of opinion, that fish had the sense of hearing, though they by no means could ascertain the auditory passage, or determine the matter by experiment. Aristotle, Scaliger, Nierembergius, Geoffrey, and Johnson, are of the same opinion; and Dr. George Serger (author of a dissertation on this subject, in the German Ephemerides) says, that "having been to take a walk with some of his friends in the fine gardens of the Archbishop of Saltzburg, the gardener conducted them to a very clear piece of water, of which the bottom was paved with stones of different colours, and in which they did not at first see any fish; but the man had no sooner rung a little bell, than a multitude of trouts came together from all parts of the pond, to take what the gardener had brought them, and disappeared as soon as they had eaten it up. The gardener assured his company that he always did the same, whenever he had a mind to give them any thing to eat. Hav-

Further remarks.

ing continued to walk about the garden half an hour longer, and returning to the pond, they had again the pleasure of seeing all the trouts re-assemble at the ringing of the bell."

A particular description of the organs of hearing belonging to several species, is also given by Geoffrey, in his *Dissertation sur l'Organe de l'Ouïe*, nor can it be thought that water is an improper medium of sound, as daily experience demonstrates, that sounds may be conveyed, not only through water, but through the most solid bodies.

One of the cetaceous division (the phocæna) having been dissected by Dr. Munro, this gentleman, after a very nice anatomical investigation, observes, with regard to the hearing of fish, "that while they float upon the surface of the ocean, impression is made on the several parts of their ear in the same manner as in man."

Many experiments have demonstrated, that sounds are conveyed through water almost with the same facility with which they move through air. A bell which is rung in water returns a tone as distinct as if it was rung in air. Derham observed that it came a quarter deeper. Naturalists in general had believed that fish had a strong perception of sounds at the bottom of deep rivers; but the anatomical researches of the above gentlemen clearly demonstrate the auricular organ in these animals. Dr. Munro, in 1780, in order to judge of the effect of sounds

Effect of sounds in water.

in water, made the following experiments. He employed two bells, the sounds of which he was used to; one of them a small tea-table bell, the other much larger and thicker, so that the sound of it could be very well heard at the distance of a quarter of a mile. When these were plunged under water and rung, he observed that the sound of them was very sensibly graver; but still the ringing tremor of both was very distinguishable. On performing an accurate experiment, the tea-table bell was found in air the highest *G* of a harpsichord; but in water it sounded a fifth false lower, or it sounded the *C* sharp under the *G*. After this he plunged his head under the water while he rung the bell in the air, and heard the sound of it distinctly. As the tone of the bell is louder and more acute in the air than in the water, its sound is necessarily better heard when the head of the person making the experiment is under the water and the bell above it, than when the bell is rung under the water while the head is above it. He next plunged his whole body with the bells, holding their handles in his hands, under the water, and then rung them, and was surprised with the loudness and distinctness of their sounds, and could readily distinguish their different tones. In like manner, when plunged under the water, he struck two stones held in his hands against each other, and was surprised with the shock communicated to the ears.

Dr. Franklin's opinion.

By this last experiment is corroborated Dr. Franklin's opinion, "That water will convey sound farther and more readily than air. He thinks he has heard a smart stroke of two stones together under water, his ear being also under water in the same river, near a mile; how much farther it may be heard he knows not, but supposes a great deal farther, because the sound did not seem faint, as if at a distance, like distant sounds through the air, but smart and strong, as if present just at the ear."

Dr. Munro, afterwards, by means of a string tied to the handle of the largest bell, and to an inflated bladder, suspended that bell in a very deep pool, six feet under the surface of the water, and took hold of a cord twelve yards long, which he had previously tied to the handle. He then plunged under the water and pulled the cord, and found the sound was instantly conveyed to his ears. In the last place, this gentleman thought of trying an experiment, to determine, whether air or water conveyed sound quickest; but there being no lake near Edinburgh about eight hundred feet broad, he found it impossible, independently of the difficulty of constructing a proper apparatus, to perform the experiment in a satisfactory and decisive way. He, however, made the following experiment. He charged three English pint bottles each with about ten ounces of gunpowder. He then inserted a tin tube four feet in length into

Experiments by Dr. Munro.

each bottle, and prevented the water from getting into the bottle by wrapping a piece of wet bladder round the neck of it and the neck of the tube which entered into it, and tying the tube and neck of the bottle to each other. After filling the tube with gun-powder, he fixed to the top of it a piece of match paper; and into the match paper, just over the top of the tube, he put two ounces of gun-powder. He then sunk the bottle near the side of a lake to the depth of about two feet, and went into the water at the greatest distance possible, which was about eight hundred feet, and laid himself on his back in the water, with his ears under its surface, and nose and eyes above it. The match was then set fire to by another person; and as it was midnight, he saw the flash of the gunpowder contained within the match, and soon after heard the noise of the explosion of the gunpowder within the bottle. But he found it impossible in this way to determine the velocity of the sound with accuracy, as the gun-powder in the bottle was not set fire to through the tube sufficiently instantaneously as to have the desired effect. The piece of water not being extensive enough, and being unprovided with a proper apparatus, the only conclusion to be then drawn was, that after the bottle burst, he heard one, but did not hear two explosions: so that the water seemed to convey the sound nearly in the same manner as the atmosphere.

Observations by J. Hunter.

To the ingenious J. Hunter, F. R. S. we are indebted for the following minute description of the organs of hearing in fish: "They are placed on the sides of the skull, or that cavity which contains the brain; but the skull itself makes no part of the organ, as it does in the quadruped and the bird. In some fish, this organ is wholly surrounded by the parts composing this cavity, which in many is cartilaginous; the skeleton of these fish being like those of the ray kind; in others also, as in cod, salmon, &c. whose skeleton is bone, yet the part is cartilaginous.

"In some fish this organ is in part within the cavity of the skull, or that cavity which also contains the brain, as in the salmon, cod, &c. the cavity of the skull projecting laterally, and forming a cavity there.

"The organ of hearing in fish appears to grow in size with the animal, for its size is nearly in the same proportion with the size of the animal, which is not the case with the quadruped, &c. the organs being in them nearly as large in the growing foetus as in the adult.

"It is much more simple in fish than in all those orders of animals who may be reckoned superior, such as quadrupeds, birds, and amphibious animals, but there is a regular gradation from the first to fish.

"It varies in different orders of fish; but in all it consists of three curved tubes, all of which unite with one another: this union forms in

Peculiar habits.

some only a canal, as in the cod, salmon, ling, &c. and in others a pretty large cavity, as in the ray kind. In the jack there is an oblong bag, or blind process, which is an addition to those canals, and which communicates with them at their union. In the cod, &c. that union of the three tubes stands upon an oval cavity, and in the jack there are two of those cavities; these additional cavities in these fish appear to answer the same purpose with the cavity in the ray or cartilaginous fish, which is the union of the three canals.

“The whole is composed of a kind of cartilaginous substance, very hard or firm in some parts, and which in some fish is crusted over with a thin bony lamella, so as not to allow them to collapse: for as the shell does not form any part of these canals or cavities, they must be composed of such substance as is capable of keeping its form.

“Each tube describes more than a semicircle. This resembles in some respect what we find in most animals, but differs in the parts being distinct from the skull.

“Two of the semicircular canals are similar to one another, may be called a pair, and are placed perpendicularly; the third is not so long; in some it is placed horizontally, uniting as it were the other two at their ends or terminations. In the skate it is something different, being only united in one of the perpendiculars.

Cursory observations.

“ The two perpendiculars unite at one part in one cavity, by one arm of each uniting, while the other two arms or horns have no connection with each other, and the arms of the horizontal unite with the other two arms of the perpendicular near the entrance into the common canal or cavity.

“ Near the union of those canals into the common, they are swelled out into round bags, becoming there much larger.

“ In the ray kind they all terminate in one cavity, as has been observed; and in the cod they terminate in one canal, which in these fish is placed upon the additional cavity or cavities. In their cavity or cavities there is a bone or bones. In some there are two bones: as the jack has two cavities, we find in one of those cavities two bones, and in the other only one; in the ray there is only a chalky substance. At this union of the two perpendiculars in some fish enters the external communication, or what may be called the external means. This is the case with all the ray kind, the external orifice of which is small, and placed on the upper flat surface of the head; but it is not every genus or species of fish that has the external opening.

“ The nerves of the ear pass outwards from the brain, and appear to terminate at once on the external surface of the swelling of the semi-circular tubes above described. They do not appear to pass through those tubes so as to get

On the teeth of fish.

on the inside as is supposed to be the case in quadrupeds; I should therefore very much suspect that the lining of those tubes in the quadruped is not nerve, but a kind of internal perioosteum."

Whether *every* species of fish be endued with the organs of hearing, especially those which are deprived of eyes, as oysters, muscles, and all testaceous fish with hard shells, certainly admits of doubt: for though in some instances they contract and shut themselves up within their cells, this seems to be operated less by the sense of hearing, than by that of feeling, which the water may excite.

Although aquatic animals possess teeth, they are not calculated for breaking the food into small morsels, but rather to grasp their prey, and hinder the creatures they have once caught from escaping again; they feed chiefly on smaller fish, or other animals that need no trituration in the mouth, but spontaneously and gradually dissolve into a liquid chyle; there are also two round bodies in the posterior part of the jaws, which, as well as the basis of the bronchi, have a number of tender-books fixed in them in such a manner, as that any thing can easily get down, but is hindered from returning.

Fish not having any thing that can be called a neck, the œsophagus, or gullet, is of course very short, and scarcely distinguished from the stomach; for in fact the food lies equally in

Remarkable for longevity.

both. The stomach is of an oblong figure; which, in large fish, is commonly found to contain some larger ones, still retaining their natural form, but when touched, melting down into a jelly. From this, and the great quantity of liquors poured into their stomachs, it is concluded that digestion is solely brought about in them by the power of a menstruum, and that no trituration happens here. The guts are very short.

No animals are more remarkable for longevity than fish, which is philosophically accounted for by Bacon, who observes, that "most of the disorders incident to mankind arise from the changes and alterations in the atmosphere; but fish reside in an element little subject to change; theirs is an uniform existence; their movements are without effort, and their life without labour. Their bones also, which are united by cartilages, admit of indefinite extension; and the different sizes of animals of the same kind, among fish, are very various. They still keep growing; their bodies, instead of suffering the rigidity of age, which is the cause of the natural decay of land animals, still continue increasing with fresh supplies; and as the body grows, the conduits of life furnish their stores in greater abundance. How long a fish that seems to have scarce any bounds put to its growth, continues to live, is not ascertained: perhaps, the life of a man would not be sufficient to measure that of the smallest."

How to know their age—Mode of dying.

Two methods have been devised for determining the age of fish; first, by the circles of the scales; secondly, by the transverse section of the back bone. When a fish's scale is examined by a microscope, it is found to consist of a number of circles one within another, in some measure resembling those which appear on the transverse section of a tree, and is supposed to give the same information. For, as the age of trees can be told by the number of their circles; so that of fish may be conjectured by the number of circles in every scale, reckoning one ring for every year of the animal's existence. The age of fish that want scales may also be known by separating the joints of the back-bone, and then minutely observing the number of rings which the surface, where it was joined, exhibits. The Rev. Mr. White gives the following account of the death of a fish. As soon as one dies, the head sinks lower and lower, and the animal stands, as it were, upon it, till becoming weaker and losing all poise, the tail turns over, and at last it swims on the surface of the water, with its belly upwards. The reason why fish, when dead, float in that manner is obvious; because, when the body is no longer balanced by the fins of the belly, the broad muscular back preponderates by its own gravity, and turns the belly uppermost, as lighter, from its being a cavity.

Voracity is the chief characteristic of these aquatic animals. In most of them, the maw is

Voracity—Fruitfulness.

placed next the mouth; and, though possessed of no sensible heat, is endued with a very surprising faculty of digestion. Its digestive power seems, in some measure, to increase in proportion to the quantity of food with which the fish is supplied. A single pike has been known to devour a hundred roaches in three days. Whatever is possessed of life seems the most desirable prey for fish; some, which have but very small mouths, feed upon worms, and the spawn of other fish; others, whose mouths are larger, seek large prey, it matters not of what kind, whether of their own species, or any other. Those with the largest mouth pursue almost every thing that hath life; and often meeting each other in fierce opposition, the fish with the largest swallow comes off victorious, and devours its antagonist. As a counterbalance to this great voracity, however, fish are incredibly prolific. Some bring forth their young alive, others produce only eggs: the former are rather the least fruitful; yet even those produce in great abundance. The viviparous blenny, for instance, brings forth two or three hundred at a time. Those which produce eggs, which they are obliged to leave to chance, either on the bottom where the water is shallow, or floating on the surface where it is deeper, are all much more prolific, and seem to proportion their stock to the danger there is of consumption. Lewenhoeck declares, that the cod spawns above nine millions in a season. The flounder

Fish, solitary or gregarious.

commonly produces about one million, and the mackarel above five hundred thousand. Scarce one in a hundred of these eggs, however, brings forth an animal: they are devoured by all the lesser fry that frequent the shores, by water-fowl in shallow waters, and by the larger fish in deep waters. Such a prodigious increase, if permitted to come to maturity, would overstock nature; even the ocean itself would not be able to contain, much less provide for, one half of its inhabitants. But two wise purposes are answered by their amazing increase; it preserves the species in the midst of numberless enemies, and serves to furnish the rest with a sustenance adapted to their nature.

Fish, like the land animals, are either solitary or gregarious. Some, as trout, salmon, &c. migrate to deposit their spawn. Of the sea-fish, the cod, herring, &c. assemble in immense shoals, and migrate in these shoals through vast tracks of the ocean.

CHAP. II.

“ Hard by the shore a fisherman espies
Two mighty *whales* which swelling seas had tost
And left them pris’ners on a rocky coast;
One as a mountain vast and with her came
A cub not much inferior to his dam.

* * * * *

The bigger whale, like some huge carrock lay
Which wanteth sea room with her foes to play.

* * * * *

The shining steel her tender sides receive,
And there, like bees, they all their weapons leave;
This sees the cub, and does himself oppose,
Betwixt the cumber’d mother and her foes.”

WALLER.

THE WHALE.

THE whale is of the cetaceous order of fish, which produce their young alive, and not from ova; and being remarkable for its immense magnitude, justly claims the first place in our account of the inhabitants of the deep.

The ancients have described the whale as being six hundred feet in length. At present it is sometimes found in the northern seas ninety feet in length, and twenty in breadth; but for-

Description.

merly they were taken of a much greater size, when the captures were less frequent, and the fish had time to grow. Such is their bulk within the arctic circle; but in those of the torrid zone, according to Adamson, where they are unmolested, whales are still seen one hundred and sixty feet long. There are many turnings and windings in this fish's nostrils, and it has no fin on the back. The head is very much disproportioned to the size of the body, being one third the size of the fish; and the under lip is much broader than the upper. The tongue is composed of a soft spongy fat, capable of yielding five or six barrels of oil. The gullet is very small for so vast a fish, not exceeding four inches in width.

There are two orifices through which it spouts water to a vast height, and with a great noise, especially when disturbed or wounded in the middle of the head. The eyes are not larger than those of an ox, and when the chrystalline humour is dried, it does not appear larger than a pea. They are placed towards the back of the head, being the most convenient situation for enabling them to see both before and behind; as also to see over them, where their food is principally found. They are guarded by eye-lids and eye-lashes, as in quadrupeds, and they seem to be very sharp-sighted. Nor is their sense of hearing in less perfection; for they are warned at great distances of any danger preparing against them. The external organ of hearing is

Whalebone.

not perceptible; but as soon as the thin scarf-skin is removed, a black spot is discovered behind the eye, and under that is the auditory canal, that leads to a regular apparatus for hearing.

The whalebone, as it is called, is placed on the inside of the mouth, and is attached to the upper jaw: it is of the same nature as horn, and is composed wholly of animal substances. It is extremely elastic, and consists of thin plates of some breadth, and in some species, of very considerable length. These plates are placed in several rows encompassing the outer skirts of the upper jaw, like the teeth in other animals. They stand parallel to each other, having one edge towards the circumference of the mouth, and the other towards the centre or cavity. The outer row is composed of the longest plates, and these are in proportion to the different distances between the two jaws, some being fourteen or fifteen feet long, but towards the anterior and posterior parts of the mouth they are very short. They rise for half a foot or more, nearly of equal breadths, and afterwards shelve off from the inner side till they come near to a point at the outer. The exterior of the inner rows are the longest, corresponding to the termination of the declivity of the outer, and becoming shorter and shorter till they severally rise above the gum. This whalebone is continually wearing down, and renewing in the same proportion.

Its tail is broad and semi-lunar; and when the

Strength of the tail—Beautiful colours.

fish lies on one side, its blow is tremendous. The tail alone it makes use of to advance itself forward in the water; and it is surprising to see with what force and celerity its enormous bulk cuts through the ocean. The fins are only made use of for turning in the water, and giving a direction to the velocity impressed by the tail. The female also makes use of them, when pursued, to carry off her young, clapping them on her back, and supporting them by the fins on each side from falling.

This fish varies in colour; the back of some being red, the belly generally white. Others are black, some mottled, others quite white. Martin says, "that their colours in the water are extremely beautiful, and their skin is very smooth and slippery." The outward, or scarf skin of the whale is not thicker than parchment; but this removed, the real skin appears of about an inch thick, and covering the fat or blubber that lies beneath: this is from eight to twelve inches in thickness; and is, when the fish is in health, of a beautiful yellow. The muscles lie beneath, and these, like the flesh of quadrupeds, are very red and rough.

It is asserted that the female courts the male, and that only once in two years. Their fidelity to each other exceeds that of most other animals, even the constancy of birds. "Some fishermen," Anderson says, "having struck one of two whales, a male and a female, that were in

Fidelity of the male and female.

company together, the wounded fish made a long and terrible resistance; it struck down a boat with three men in it, with a single blow of its tail, by which all went to the bottom. The other still attended its companion, and lent it every assistance; till, at last, the fish that was struck, sunk under the number of its wounds, whilst its faithful associate, disdaining to survive the loss, with great bellowing stretched itself upon the dead fish, and shared his fate.

The female goes with young nine or ten months, and is then fatter than usual, particularly when near the time of bringing forth. She generally produces one young one, and never above two. When she suckles her young, she throws herself on one side on the surface of the sea, and the young attaches itself to the teat. She is remarkably careful of her offspring, which she carries with her wherever she goes, and, when hardest pursued, keeps it supported between her fins. Even when wounded, she still clasps her young one, and when she plunges to avoid danger, takes it to the bottom, but rises sooner than usual, to give it breath again. The following story, founded on historical authority is related by Goldsmith and others. "A whale and her cub had got into an arm of the sea, where, by the defection of the tide, they were entirely enclosed. The people on shore beheld their situation, and drove down upon them in

Maternal affection.

boats, with such weapons as could be hastily collected. The animals were soon severely wounded, and the sea tinged with their blood. After several attempts to escape, the old one forced over the shallow into the depths of the ocean. But though in safety herself, she could not bear the danger that awaited her young one; she therefore rushed in once more where the smaller animal was confined, and resolved, when she could not protect, at least to share its danger. The tide, however, coming in, enabled both to escape from their enemies, though not without sustaining an infinite number of wounds in every part." Waller has introduced this anecdote in his *Summer Islands*, of which the motto to the present chapter forms a part.

The young one continues at the breast for a year, during which time, they are called by the sailors, short-heads. They are then extremely fat, and yield above fifty barrels of blubber. The mother at the same time is equally lean and emaciated. At the age of two years they are called stunts, as they do not thrive much immediately after quitting the breast; they then yield scarce above twenty or twenty-four barrels of blubber: from that time forward they are called sheill-fish, and their age is wholly unknown.

Every species of whale propagates only with those of its kind, and does not at all mingle with the rest; however, they are generally seen in

shoals, of different kinds together, and make their migrations in large companies from one ocean to another.

The sword-fish, the thresher, and a kind of shark, are bitter enemies to the whales, which are themselves shy and timid animals, being possessed of no weapons of defence or offence, except their tails. They are gregarious, and their principal food consists of some species of crabs and medusæ. There is a small animal of the shell-fish kind called the whale-louse, which sticks to them; and, notwithstanding all their exertions to get it off, it adheres to their bodies, and lives upon their fat.

The spermaceti whale has a kind of fat called spermaceti, which is found every where in the body in small quantity mixed with the common fat; but it is in the head that the greatest portion is found. See *Cachalot*. The flesh of the whale is very dry and insipid.

The fin fish is distinguished from the common whale by a fin on the back, placed very low and near the tail. The length is equal to that of the common kind, but much more slender. It is furnished with whale-bone in the upper jaw mixed with coarse hair, but short, knobby, and of little value. The blubber in the body is very inconsiderable; it is extremely fierce, and the capture of it both difficult and dangerous, on which account it is entirely neglected by the fishermen, who, on its appearance, retire out of

Pike-headed whale—Musculus—Nar-whale.

those seas. The natives of Greenland, however, hold it in much esteem, as it affords a quantity of flesh which, to their palate, is very agreeable. The lips are brown, and like a twisted rope; the spout-hole appears to be split in the top of its head, through which it blows its water with much more violence, and to a greater height, than the common whale.

The pike-headed whale, has a double pipe in its snout, three fins like the former, and a hard horny ridge on its back; and the belly is full of longitudinal folds. This species takes its name from the shape of its nose, which is narrower and sharper-pointed than that of the other whales. It has been taken on the coast of Scotland of the length of forty-six feet, and twenty in circumference.

The musculus has a double pipe in its front, and three fins; the under jaw is much wider than the upper one. It is frequently found along the coasts of Scotland, and feeds upon herrings.

The nar-whale differs from the foregoing species most materially by its large teeth pointing directly forward from the upper jaw, from nine to fourteen feet in length; and of all the weapons with which the marine animals are gifted, this is doubtless the most formidable. The nar-whale is seldom so long as the common whale, much slenderer, and less abounding in blubber: in other respects their manners and appetites are perfectly similar; they are harmless, peaceable,

Formidable weapon.

and rather avoid than seek contention. They are gregarious, and seldom found alone; but so rapid in their flight, that they could seldom be taken but for those very teeth which seem intended for their chief defence; for when attacked in a crowd, they are so embarrassed and locked together by their tusks that some are certain of falling a prey to the fishermen. This curious weapon is commonly straight as an arrow, about eight or ten inches in thickness, generally wreathed like twisted bars of iron, and is whiter, heavier, and harder than ivory, which it far surpasses in all its qualities. The extreme length of them has induced naturalists to consider them rather as horns than teeth, though in every respect resembling the tusks of the boar and the elephant. It springs from the left side of the head, from a socket in the upper jaw, into which its root enters above a foot and a half, and darts directly forward in a line with the body. The animal is generally found with but one of these dreadful instruments. Nor is this defensive weapon confined to the male sex, as both have been found armed in the same manner.

By the whale tribe we are supplied with three valuable articles, oil, whalebone, and spermaceti, which renders the whale-fishery, in a commercial point of view, of great importance to mankind. We shall therefore conclude this article with a brief account of the whale fishery, which

Whale fishery.

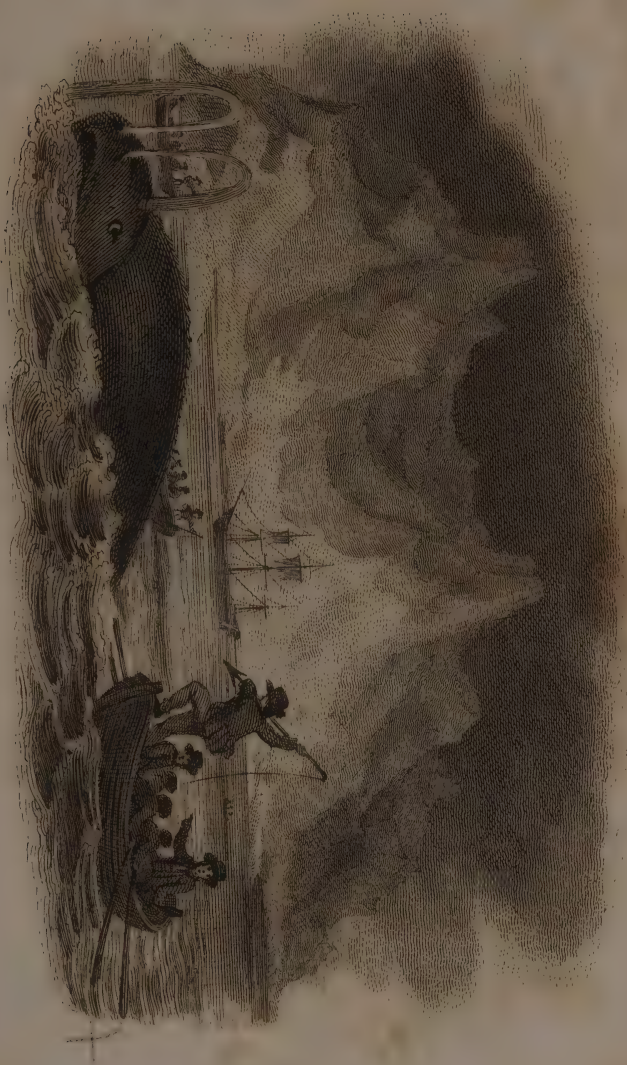
the reader will find has also been the subject of our artist's pencil.

Whales are chiefly taken in the Northern Seas. The English sends out with every ship six or seven boats; each of these has one harpooner, one man at the rudder, one manager of the line, and four seamen to row it. In each boat there are also two or three harpoons, several lances, and six lines, each one hundred and twenty fathoms long, fastened together.

As soon as the whale is struck with the harpoon it darts into the deep, carrying the instrument off in his body; and so rapid is its motion, that if the line were to entangle, it would either snap like a thread, or upset the boat: one man therefore is stationed to attend only to the line that it may go regularly out, and another is also employed in continually wetting the place it runs against that the wood may not take fire from the friction. It is very wonderful indeed, that an animal so large should be able to cut through the water with such velocity, his flight being as rapid as that of an eagle.

On the whale's return to breathe, the harpooner inflicts a fresh wound, till at length, fainting from loss of blood, the men venture the boat quite up to him, and a long steeled lance is thrust into his breast and other parts, which soon put an end to his existence.

When the carcase begins to float, holes are



WHALE FISHERY.

Mode of cutting up the carcase.

cut in the fins and tail, and ropes being fastened into these, he is towed to the ship, where he is fastened along the larboard side, floating with his back on the water.

In order to take out the blubber and whalebone, several men now get upon the animal with iron calkers or spurs, to prevent their slipping, and separate the tail, which is hoisted on deck. They then cut out square pieces of blubber, weighing two or three thousand pounds each, which by means of the capstan, are also hoisted up. These are cut into smaller pieces, which are thrown into the hold, and left for three or four days to drain. When all the blubber is cut from the belly of the fish, it is turned on one side, by means of a piece of blubber left in the middle, called the cant, or turning piece. They then cut out this side in large pieces as before, and also the whalebone, with the gums, which are presented entire, and hoisted on deck, where the blades are cut and separated, and left till the men have time to scrape and clean them. The whale is next turned with its back upwards, and the blubber cut out from the back and crownbone: they conclude the whole by cutting the blubber from the other side. Before, however, the remainder of the body is let to float away, they cut out the two large upper jaw-bones, which are hoisted on deck, cleansed, and fastened to the shrouds, and tubs are placed under

Value of a whale.

them to receive the oil which they discharge; which oil belongs to the captain.

In three or four days they hoist the pieces of blubber out of the hold, chop and put them by in small pieces through the bung-holes into the casks.

A whale, the longest blade of whose mouth measures nine or ten feet, will yield about thirty butts of blubber; but some of the largest will yield upwards of seventy. One of the latter is generally worth about one thousand pounds sterling; and a full ship of about three hundred tons burthen, will produce more than five thousand pounds from one voyage.

Premiums on every whale that is taken, are given to all engaged, from the captain to the men who row the boats, which render them active in the service of their employers.

The whale-fishery begins in May, and continues through the months of June and July; but whether the ships have had good or bad success, they must come away and get clear of the ice by the end of August: so that in the month of September, at furthest, they may be expected home; but the more fortunate ships often return in June or July.

THE CACHALOT,

OF which there are seven different species as enumerated by Mr. Pennant. One of the leading characteristics of the cachalot is a number of teeth in the under jaw, but none in the upper. It is by no means of such an enormous size as the common whale. The blunt-headed cachalot has a head exceedingly out of proportion, making in bulk one half of the whole body: this is as flat at the end, and as thick there as in the middle. It grows to the length of about sixty feet, and the circumference of thirty. The tongue is small, but the throat, in contradistinction to the former tribe, is amazingly capacious, so that at one gulp it can swallow shoals of the smaller fish down its enormous gullet, which has been described as extensive enough to admit an ox. Crantz says, that one of these creatures being struck, threw up a shark quite whole, and four yards long; and at the same time there were found in its stomach bones of fish that were a fathom long. Of this kind must be the whale that swallowed Jonah the prophet.

The cachalot race yields a smaller quantity of oil than the common whale, which, however is amply atoned for by its affording so abundantly the two valuable articles of spermaceti and ambergris.

It is in the cavities of the head of this species,

First discovery of the spermaceti.

that the spermaceti is taken, which cavities are from twenty to thirty in number, and covered with the common integuments or skin. The perfume called ambergris, is formed within its intestines, and when the animal is sick, this is ejected thence in large quantity.

The spermaceti is a fine, bright, white, and semi-pellucid matter, composed of a fine surfaracious substance, formed into oblong flakes, very light, soft, and unctuous to the touch, inflammable, soluble in oil, but not in watery menstrua; of scarce any smell when fresh and fine, and of a soft, agreeable, and unctuous taste. The largest, firmest, and whitest flakes of it are to be chosen. It is liable to become rancid and yellowish in keeping; and the smaller fragments contract this bad quality sooner than the larger.

It seems the first knowledge mankind had of spermaceti, was the finding it swimming on the surface of the water in the northern seas: and we are not to wonder that people who knew no more of its origin than what they were informed of by those who found it so floating on the sea, referred it to the mineral class; supposing it to be bitumen formed in the bowels of the earth, and thrown up from the bottom of the ocean, as was the opinion of Schroder, and others of his time. It was soon after discovered, however, that the head of a peculiar species of whale afforded a fatty substance, which, when boiled, and properly prepared, was analogous to this.

Spermaceti now made from any whale oil.

And here it was soon deduced, that the masses of it first found were of the same origin; that they had been formerly an oily matter in this fish, which, getting loose, on the perishing of the dead carcase, or by any other means, had been washed and bleached by the salt water, and the sun, into the form in which it was then found. The opinion of its being the sperm, or semen, of the whale, was about as early as the first discovery that it belonged to that animal, and seems to have been formed merely on account of its whiteness.

At first the spermaceti of the shops was made from the head of this fish; the oil obtained from its brain, and the diploe of the cranium, furnishing the whole; and hence the considerable price it was then kept at. It was some time after found out, however, that *any* whale oil would do as well as this, which occasioned the price to fall considerably. At present it is made in England from whale oil of any kind, the settling of our oilmen's large vessels, particularly, which are boiled with a quantum of German pot-ash, or pearl-ashes, till white and firm; and after several other meltings, and a thorough separation of what saline particles might have got into the matter, it is, when cold, cut out with knives into flakes. The process is easy, but it requires care, and nice inspection towards the end: if not enough boiled, it is apt to turn yellow, and soon grow rancid,

Best spermaceti—Ambergris.

The best spermaceti, however, is from the cavities of the eachalot's head. The first cavity is filled with that spermaceti which is supposed of the greatest purity and highest value. Seven barrels of the clearest spermaceti is generally the produce of this cavity, which, when thrown upon water, coagulates like cheese. There is also another chamber or cavity, just over the gullet, about seven feet high that affords a considerable quantity, though of less value than the first. It is observable, that in proportion as the oily substance is drawn from this part, it fills again from every part of the body. The spinal marrow also affords no inconsiderable quantity. This substance has become not more an article of manufacture than a medicine; and of which candles, cheaper, though not less elegant than wax, are plentifully made.

The ambergris is a solid, opaque, ash-coloured, fatty inflammable substance, variegated like marble, remarkably light, rugged and uneven in its surface, and has a fragrant odour when heated. It is found swimming upon the sea, or the sea coast, or in the sand near the sea coast; especially in the Atlantic Ocean, on the sea coast of Brasil, and that of Madagascar; on the coast of Africa, of the East Indies, China, Japan, and Molucco Islands; but most of the ambergris which is brought to England, comes from the Bahama islands, from Providence, &c. where it is found on the coast. It is also sometimes

Ambergris supposed to proceed from sickness.

found in the abdomen of whales by the whale fishermen, always in lumps of various shapes and sizes, weighing from half an ounce to a hundred or more pounds.

The persons who are employed in the spermaceti whale fishery, confine their views to the blunt-headed cachalot. Whenever they hook one, they observe, that it constantly not only vomits whatever it has in its stomach, but also commonly discharges its fæces at the same time; and if the latter circumstance takes place, they are generally disappointed in finding ambergris in its belly. But whenever they discover a blunt-headed cachalot, male or female, which seems torbid and sickly, they are always pretty sure to find ambergris, as the fish in this state seldom voids its fæces upon being hooked. They likewise meet with it in the dead ones, which they sometimes find floating on the sea. It is observed, that all those whales, in whose bowels ambergris is found, seem not only torpid and sick, but are also constantly leaner than others; so that if we may judge from the constant union of these two circumstances, it would seem that a larger collection of ambergris in the belly of the whale is a source of disease, and probably sometimes the cause of its death. As soon as they hook a whale of this description, torpid, sickly, or emaciated, they immediately either cut up the above-mentioned protuberance, if there be any, or they rip open its bowels from the ori-

Goodness of ambergris depends on its age.

fice of the anus, and find the ambergris sometimes in one, sometimes in different lumps, of generally from six to twelve and more inches in diameter, and from one pound to twenty or thirty pounds in weight.

All ambergris, when taken out of whales, has very nearly the same smell as the liquid excrement of the animal, as well as the same blackish colour: and it is a matter of fact, that after being taken out and kept in the air, all ambergris grows not only harder and whiter, but also loses, by degrees, its smell, and assumes such an agreeable one, as that in general has which is found swimming upon the sea; therefore the goodness of ambergris seems much to depend upon its age; and the only reason why ambergris found floating on the sea is of better quality, is its greater age and longer exposure to the air. It is more frequently found in males than females; the pieces in the latter being generally smaller, and the quality inferior.

The cuttle-fish is the constant and natural food of the cachalot. Of this the fishers are so well persuaded, that whenever they discover any recent relics of it swimming on the sea, they conclude that a whale of this kind is, or has been, in that part. Another circumstance which corroborates the fact is, that the cachalot, on being hooked, generally vomits up some remains of the sepia. Hence it is easy to account for the many beaks, or pieces of beaks, of the sepia found in

Strange imitation of ambergris.

all ambergris. The beak of the sepia is a black horny substance, and therefore passes undigested through the stomach into the intestinal canal, where it is mixed with the fæces; after which it is either evacuated with them, or if these latter be preternaturally retained, forms concretions with them, which render the animal sick and torpid, and produce an obstipation, which ends either in an abscess of the abdomen (as has been frequently observed) or becomes fatal to the animal; whence in both cases on the bursting of its belly, that hardened substance, known by the name of ambergris, is found swimming on the sea, or thrown upon the sea coast.

It is very remarkable, that this drug, which is the most sweet of all perfumes, should be capable of being imitated in smell, by a preparation of the most odious of all stinks. Mr. Hornbey found, that a vessel in which he had made a long digestion of the human fæces, acquired a very strong and perfect smell of ambergris, insomuch that any one would have thought a great quantity of essence of ambergris had been made in it. The perfume was so strong and offensive, that the vessel was obliged to be removed out of the laboratory.

CHAP. III.

" But, past belief, a dolphin's arched back
Preserv'd Arion from his destin'd wreck,
Secure he sits, and with harmonious strains,
Requites the bearer for his friendly pains."

TRANS. OF OVID.

THE DOLPHIN.

THE dolphin has an almost straight shape, the back being very slightly incurvated, and the body slender; the nose is long, narrow, and pointed, with a broad transverse band, or projection of the skin on its upper part. It has twenty-one teeth in the upper, and nineteen in the lower jaw, somewhat above an inch long, conic at the upper end, sharp pointed, and bending a little in. They are placed at a small distance from each other; so that when the mouth (which is very wide) is shut, the teeth of both jaws lock into each other: the spout-hole is placed in the middle of the head; the tail is semi-lunar; the skin is smooth; the colour of the back and sides

Voracious, active, and roving.

dusky; the belly whitish; it swims with great swiftness, and its prey is fish. The dolphin is longer and more slender than the porpesse, measuring nine or ten feet in length, and two in diameter.

All these species have fins on the back; very large heads, like the rest of the whale kind; and resemble each other in their appetites, their manners, and conformation, being equally voracious, active, and roving. No fish could escape them, but from the awkward position of their mouth, which is placed in a manner under the head; and their own agility is so great as to prevent them from being often taken. They seldom remain a moment above water though their too eager pursuit after prey sometimes exposes them to danger; a shoal of herrings often allures them out of their depth, and they continue to flounder in the shallows till knocked on the head, or the returning tide comes to their relief. And when taken they sometimes have a plaintive moan, with which they continue to express their pain till they expire.

A shoal of dolphins will frequently attend the course of a ship for the scraps that are thrown overboard, or the barnacles adhering to their sides. They inhabit the European and Pacific ocean.

This fish was in great repute with the ancients; it was consecrated to the Gods, celebrated in the

 Ridiculous fables of the dolphin.

earliest time for its fondness of the human race, honoured by the title of the sacred fish, and distinguished by those of boy-loving and philanthropist. It gave rise to a long train of ridiculous fables. Scarce an accident could happen at sea, but the dolphin offered himself to convey to shore. By the seamen of the present day they are held rather in abhorrence than esteem, for their frolics on the surface of the water are almost sure signs of an approaching storm.

In leaping out of the water, this fish assumes a temporary curvature that is not natural to them; but which the painters and poets (who, perhaps on this occasion borrowed from each other) have constantly given them; and which has indeed become too general an error.

“ Upon the swelling waves the dolphins show
 Their bending backs, then swiftly darting, go,
 And in a thousand wreaths their bodies throw.” }

The dolphin was formerly reckoned a delicacy: Dr. Caius says, that one which was taken in his time (in the reign of Elizabeth) was thought a present worthy the Duke of Norfolk, who distributed part of it among his friends. It was roasted and dressed with porpesse sauce, made of crumbs of fine white bread, with vinegar and sugar. The flesh, however, though tolerably well tasted, is dry and insipid: the best parts are near the head. It is seldom eaten now but when

Numerous in all the British seas.

young and tender. Dolphins are said to change their colour before they die, and again after they are dead.

THE PORPESSE.

THE general form of the porpesse very much resembles that of the dolphin. It is however somewhat less in size, and has a snout much broader and shorter. It is generally from six to seven feet in length; its body is thick towards the head, but grows slender towards the tail, forming the figure of a cone. In each jaw are forty-eight teeth, small, sharp-pointed, and moveable; and so placed that the teeth of one jaw lock into those of the other. The eyes are small, as is the spout-hole at the top of the head. In colours the back is black, and the belly whitish, but they sometimes vary.

Porpesses are very numerous in all the British seas, particularly in the river St. Laurence, where there is a white kind. Dr. Borsale in his voyage to the Scilly Isles, observed a small species of cetaceous fish, which he calls thornbacks, from their broad and sharp fin on the back. Some of these were brown, some quite white, others spotted; but whether they were only a variety of this fish, or small grampusses, which are also spotted, cannot be determined. The porpesse is remarkable for the vast quantity of fat or lard

Violence in pursuit of its prey.

that surrounds its body, and yields an excellent oil. The nose being furnished with very strong muscles, that enable it to turn up the sand for eels and sea worms, it is thence in many places called the sea-hog: and the animal sleeps with its snout above the water.

These animals live chiefly on the smaller fish; at the season when mackerel, herring, pilchards, and salmon appear, the porpesses swarm, and pursue them even up the rivers with great avidity, following their game like a pack of hounds. In Cornwall, during the pilchard season, they often do much mischief, by an universal laceration of the nets, and interrupting the fishery. In some places they almost darken the sea, as they rise above water to take breath, which they do very frequently. As the porpesses generally frequent the rivers in shoal water, the natives of Canada adopt the following method of catching them. When the fishing season arrives, they collect together a great number of sallow twigs, or slender branches of other trees, and stick them pretty firmly into the sand-banks of the river, which at low water are left dry; this is done on the side towards the river, forming a long line of twigs at moderate distances, which at the upper end is connected with the shore, an opening being left at the lower end that they may enter. As the tide rises it covers the twigs so as to keep them out of sight; the porpesse, in quest of his prey, gets within the line, where he continues

Simple mode of taking it.

his chase till he finds by the ebbing of the tide, that it is time to retire into deeper water. He now makes towards the river, but the twigs being then in part above the water, and so agitated by the current, he no sooner sees them shaking about than he takes fright and retreats backwards as far as he can. The tide still continuing to ebb, he returns time after time, but never being able to overcome his dread, rolls about until he is deserted entirely by the water, when those who placed the snare, rush out properly armed, and in this defenceless state, overpower him with ease. Thus a hundred of these huge creatures have by this simple stratagem been killed at one tide.

The porpesse was a royal dish even so late as the reign of Henry VIII. and it continued in vogue even in the reign of Elizabeth. It is said to have been occasionally introduced at the tables of the old English nobility. It was eaten with sugar and vinegar. It is now, however, generally neglected even by the sailors.

In America the skin of the porpesse is tanned and dressed with considerable care: at first it is extremely tender, and near an inch thick; but it is shaved down till it becomes somewhat transparent. It is made into waistcoats, and breeches by the inhabitants, and is said also to make an excellent covering for carriages.

Such is the violence of the porpesse in pursuit of its prey, that it will follow a shoal of small

Dexterity—Value—Well tasted when young.

fish up a fresh water river, from whence it finds a difficulty to return. These creatures have been often taken in the river Thames, both above and below London-bridge; and it is curious to observe with what dexterity they avoid their pursuers, and how momentarily they recover their breath above the water. It is usual to spread four or five boats over the part of the river where they are seen, and to fire at them the instant they rise.

One porpesse yields about a hogshead of oil, and therefore renders its capture an object of consideration. The lean of the young ones is also said to be well tasted, and not unlike veal. They go with young ten months, seldom bring forth more than one at a time, and generally in the summer; from the ova found in this fish, a kind of caviare is made, which is eaten as a sauce, or with bread. It is conjectured that they live about thirty years.

THE GRAMPUS,

CALLED by Pliny “an immense heap of flesh armed with dreadful teeth,” is from fifteen feet long to twenty-five; and so thick in proportion to its length, that one of eighteen feet long is, in the thickest part, more than ten feet in diameter. There are thirty teeth in each jaw; those before are blunt, round, and slender;

the farthest sharp and thick, and which lock into each other like those of the porpesse. The spout-hole is in the top of the neck; the colour of the back is black, but on each shoulder is a large white spot; the sides marbled black and white, the belly of a snowy whiteness. The back fin sometimes measures six feet in length. They seldom appear on our coasts, but are found in great quantities off the North Cape in Norway, whence they are termed North Capers.

The grampus is of a very ferocious disposition, and feeds on the larger fish. It fastens on the whale like a dog on a bull, till the animal roars with pain. It is so voracious as not even to spare the dolphin or porpesse, and it is said also to devour seals, which it occasionally finds sleeping on the rocks, dislodging it by means of its back fin, and precipitating them into the water.

From their agility, these fish are not often taken. They seldom remain a moment above water, but their eager pursuits sometimes throw them off their guard, and allure them into the shallow waters. In this case the hungry animal frequently continues to flounder about till either knocked on the head by those who discover it, or till the tide comes seasonably to its relief.

THE BELUGA

IS from twelve to eighteen feet in length, has a short head, blunt nose, very minute eyes, and a small mouth, with thirty-six short blunt teeth; the pectoral fins nearly of an oval form; and beneath the skin may be felt the bones of five fingers, which terminate at the edge of the fin in five very sensible projections. The tail is divided into two lobes, which lie horizontally, but do not fork, except a little at the base, and it has no dorsal fin. In swimming, this fish bends its tail under it like a lobster, and works it with such force as to dart along with the rapidity of an arrow.

This fish is common in all the arctic seas, and forms an article of commerce, being taken on account of its blubber. There are fisheries for them and the porpesse in the river St. Laurence. A considerable quantity of oil is extracted from them; and of their skin is made a sort of morocco leather, thin, yet strong enough to resist a musket ball. They are usually caught in nets, but are sometimes harpooned. They bring forth only one young at a time, which is dusky, but grows white in proportion to its age, the change first commencing on the belly. They are apt to follow boats, as if they were tamed, and appear extremely beautiful, by reason of their resplendent whiteness.

CHAP. IV.

"Increasing still the terrors of the storm,
His jaws terrific arm'd with threefold fate,
Here dwells the direful *shark*. Lur'd by the scent
Of steaming crowds, of rank disease and death,
Behold! he rushing cuts the briny flood,
Swift as the gale can bear the ship along,
And, from the partners of that cruel trade
Which spoils unhappy Guinea of her sons,
Demands his share of prey—demands themselves."

THOMSON.

THE SHARK.

THIS voracious animal may justly be ranked next to the whale in magnitude, as it is often found near thirty feet in length, and of corresponding weight and bulk. The skin is covered with very slender prickles, and the upper part of the tail is generally longer than the lower. Its mouth and throat enormously wide, and capable of admitting a human carcase; which has been repeatedly found in their bellies. Its head is large and flatted; its snout is long, and the eyes large and goggling, projecting in such a manner as to enable it to behold its prey on every side. But the teeth are the most formidable

Formidable teeth—Malignant aspect.

part of its composition; they consist of six rows, amounting to one hundred and forty-four in number, hard, sharp-pointed, and wedge-like in their form; and the creature is possessed of the singular power of erecting or depressing them at pleasure. They lie flat in his mouth when at rest, but by the help of a set of muscles he is enabled to erect them when he wishes to seize his prey; on which he can inflict at once an hundred wounds.

The aspect of the shark is peculiarly expressive of the malignity of his character; he is dreaded by the lesser tribes, and is scarcely less obnoxious to those apparently more powerful; for he surpasses the whale in strength and celerity not more than he exceeds all the rest in his insatiable appetites. His fins are larger in proportion than those of most fish; and his skin is rough, hard, and prickly, and of which shagreen is made for covering instrument cases, &c. His powers of destruction are only counterbalanced by the difficulty he meets with in seizing his prey; for his upper jaw projects so far over the lower, that he is obliged to turn on one side in order to accomplish his purpose; and thus afford his affrighted victims the only probability of escape. The flesh is tough, coarse, and of such a disagreeable smell, that even the young are scarcely eatable. The body emits a phosphoric light in the dark. The liver affords a few quarts of oil.

Means employed to take him.

Mr. Pennant observes, that the female is larger than the male in this tribe; a circumstance strongly characteristic of their nature, and forming a striking agreement between them and birds of prey. With respect to the fecundity of these animals, Belonius says, that he saw a female shark produce eleven live young ones at a time.

Among its singularities may be reckoned its enmity to man, or rather its love of human flesh; which when it has once tasted, it never desists from haunting those places where it expects the return of the prey; along the coasts of Africa, where these animals are found in great abundance, numbers of the negroes, who, for various purposes, are obliged to frequent these waters, are seized and devoured by them every year; and it is added, that they manifest a preference to the flesh of the black men. But though the shark may be called a common enemy, he has no opposition but from the human race, who have contrived different methods to destroy him. He often falls, however, a victim to his own rapacity, by means of the stratagems employed to take him; the method of doing which, with our English sailors, is to bait a large hook with a piece of pork, which is thrown into the sea by a strong cord, strengthened near the hook by an iron chain. Without this precaution the shark would quickly bite the cord in two; and set himself at liberty. The struggle with temptation, even when this voracious animal is not pressed

Terrible in the agonies of death.

by the call of appetite, is amusing to observe. He approaches, examines, and swims round it: seems for a while to neglect it, as if apprehensive of the delusion; but his voracity encreasing, he returns as if ready to seize it, but apprehension again drives him back: thus, like a youthful sinner, he keeps agitated between desire and fear, while the sailors continue to divert themselves with his contending passions, till they make a pretence of drawing the bait away, when propelled by every appetite at once, he darts rapidly at the bait, and makes one ravenous gulp of it, hook and all. When the hook is lodged in his maw, his efforts are most strenuously, though vainly, exerted to get free: he endeavours to cut the chain with his teeth; he labours with all his force to break the line; and his exertions to disgorge the hook, almost turn his stomach inside out; until enfeebled by unsuccessful attempts, and quite exhausted of his strength, he permits the sailors to drag him out of his native element, and dispatch him, which is done by repeated and severe blows on the head.

In dragging him, however, on ship-board, much caution is necessary; and much difficulty and danger are frequently experienced: for in the agonies of death he is terrible, and struggles powerfully with his executioners: his head and tail are secured and fastened at the same time; but the latter is afterwards frequently cut off with an axe, to prevent his flouncing, the consequence

Anecdote by Dr. Goldsmith.

of which might be highly dangerous. And such is the degree of vitality, or strength of the vital principle in the shark, that he is killed with more difficulty than almost any other animal in the world; it moves about long after the head is cut off, and even when cut in pieces, the muscles still preserve their motion, and vibrate for minutes after being separated from the body.

We are told by Dr. Goldsmith, that a Guinea captain was, by stress of weather, driven into the harbour of Belfast, in Ireland, with a lading of very sickly slaves, who took every opportunity to throw themselves overboard, when brought upon deck, as is usual, for the benefit of the fresh air. The captain perceiving among others, a woman slave attempting to drown herself, pitched upon her as a proper example for the rest. As he supposed that they did not know the terrors attending death, he ordered the woman to be tied with a rope under the arm-pits, and so let her down into the water. When the poor creature was thus plunged in, and about half-way down, she was heard to give a terrible shriek, which at first was ascribed to her fears of drowning; but soon after, the water appearing red all around her, she was drawn up, and it was found that a shark, (but of what species is not ascertained) which had followed the ship, had bitten her off from the middle.

THE BLUE SHARK.

THE body of this animal is of a fine blue colour, dark on the back, lighter on the sides; the fins and tail of a dirty blue; the belly, and all the under part of the fish white. No orifices are to be seen behind the eye, as is usual with fish of this genus. Two white membranes, one to each eye, perform the office of eye-lids. When the head was placed downwards, a pretty large white pouch came out of its mouth. Ælian supposes this to serve as an asylum to the young brood in time of danger; and Mr. Pennant, who gives credit to the story, thinks that this fish, like the opossum, may have a place fitted by nature for the reception of her young. This, however, has been denied by some writers. In 1779 a shark of this species was caught on the coast of Devonshire, the skin of which was stuffed and deposited in the British Museum.

THE WHITE SHARK.

THIS shark has six rows of teeth, hard, sharply-pointed, and of a wedge-like figure. These he has the power of erecting and depressing at pleasure. When at rest, they are quite flat in his mouth; but when his prey is to be seized, they are instantly erected by a set of

Dreadful accident.

muscles that join them to the jaw. Thus, with open jaws, goggling eyes, and large and bristly fins, agitated like the mane of a lion, his whole aspect is an emphatical picture of the fiercest, deepest, and most savage malignity. These creatures are the dread of sailors in all the hot climates, where they constantly attend the ships, in expectation of what may drop overboard; and if, in this case, any of the men have that misfortune, they must inevitably perish.

Mr. Pennant was informed by the master of a Guinea ship, that a rage for suicide prevailed among his slaves, from an opinion entertained by the unfortunate wretches that, after death, they should be restored to their families, friends, and country. To convince them that their bodies could never be re-animated, he ordered the corpse of one that was just dead to be tied by the heels to a rope, and lowered into the sea. It was drawn up again as quickly as the united force of the crew could do it; yet, in that very short time, the sharks had devoured every part but the feet, which were secured by the end of the cord.

Mr. Brook Watson, (an alderman of London) was, in his youth, swimming at a little distance from a ship, when he saw a shark making towards him. Struck with terror at its approach, he immediately cried out for assistance. A rope was instantly thrown out; and while the men were in the act of drawing him up the ship's side, the monster darted after him, and, at a single snap,

Valour of a seaman,

tore off his leg. This dreadful accident our readers will find is the subject of the annexed engraving.

In the pearl-fisheries of South America, every negro, to defend himself against these animals, carries with him into the water, a sharp knife; which, if the fish offer to assault him, he endeavours to strike into its belly; on which it generally swims off. The officers who are in the vessels keep a watchful eye on these voracious creatures; and, when they observe them approach, shake the ropes fastened to the negroes to put them on their guard. Many, when the divers have been in danger, have thrown themselves into the water, with knives in their hands, and hastened to their defence: but too often all their dexterity and precaution have been of no avail.

In the reign of Queen Anne, as recorded by Hughes, a merchant ship arrived at Barbadoes from England, some of the men of which were one day bathing in the sea, when a large shark appeared, and sprung forwards directly at them. A person from the ship called out to warn them of their danger; on which they all immediately swam to the vessel, and arrived in perfect safety, except one poor fellow who was cut in two by the shark almost within reach of the oars. A comrade and intimate friend of the unfortunate victim, when he observed the severed trunk of his companion, was seized with a degree of horror

Whose friend was severed in two.

that words cannot describe. The insatiable shark was seen traversing the bloody surface in search of the remainder of his prey, when the brave youth plunged into the water, determining either to make the shark disgorge, or to be buried himself in the same grave. He held in his hand a long and sharp-pointed knife, and the rapacious animal pushed furiously towards him: he had turned on his side, and opened his enormous jaws, in order to seize him, when the youth, diving dexterously seized him with his left hand somewhere below the upper fins, and stabbed him several times in the belly. The shark, enraged with pain, and streaming with blood, plunged in all directions in order to disengage himself from his enemy. The crews of the surrounding vessels saw that the combat was decided; but they were ignorant which was slain, till the shark, weakened at length by loss of blood, made towards the shore, and along with him his conqueror; who, flushed with victory, pushed his foe with redoubled ardour, and, with the aid of an ebbing tide, dragged him on shore. Here he ripped up the bowels of the animal, obtained the severed remainder of his friend's body, and buried it with the trunk in the same grave.

An Indian, on the coast of California, on plunging into the sea, was seized by a shark; but, by a most extraordinary feat of activity, cleared himself, and, though considerably wounded, threw blood and water at the animal to show

Temerity of the South-Sea islanders.

his bravery and contempt. But the voracious monster seized him with horrid violence a second time, and in a moment dragged him to the bottom. His companions, though not far from him, and much affected by the loss, were not able to render him any assistance whatever.

The West-Indian negroes often venture to contend with the shark in close combat. They know his power to be limited by the position of his mouth underneath; and, as soon as they discover him, they dive beneath, and in rising, stab him before he has an opportunity of putting himself into a state of defence. Thus do boldness and address unite in triumph over strength and ferocity.

According to Captain Portlock's account the South-Sea islanders are not in the least afraid of the sharks, but will swim among them without exhibiting the least signs of fear. "I have seen," says that gentleman, "five or six large sharks swimming about the ship, when there have been upwards of a hundred Indians in the water, both men and women: they seemed quite indifferent about them, and the sharks never offered to make an attack on any of them, and yet at the same time would seize our bait greedily; whence it is manifest that they derive their confidence of safety from their experience, that they are able to repel the attacks of those voracious creatures.

Notwithstanding the voracity of these crea-

Description.

tures, it is asserted, that they will not devour any feathered animal that is thrown overboard; but that they will readily take a bait of a piece of flesh fastened on an iron crook.

THE BASKING SHARK.

THIS, though a very large fish, possesses none of the voracity and ferociousness that mark the generality of the shark tribe. It will frequently lie motionless on the surface of the water, generally on its belly, but sometimes on its back; and it seems so little afraid of mankind as often to suffer itself to be patted and stroked. Its body is slender, and from three to twelve yards in length, of a deep lead colour above, and white below. The upper jaw is blunt at the end, and much longer than the lower. The mouth is placed beneath, and furnished with small teeth; these before much bent, and the remote ones conical and sharp-pointed. On each side of the neck are five breathing apertures. There are two dorsal, two pectoral, two ventral fins, and one small anal fin. Within the mouth, near the throat, is a short kind of whalebone. The liver is of such immense size as frequently to weigh near a thousand pounds. From this a great quantity of good oil is extracted; which renders this shark an animal of considerable importance

Derivation of its name.

to the Scotch fishermen: for, according to Anderson, the oil of a single fish will sometimes sell for twenty or thirty pounds sterling.

The basking shark (which derives its name from its propensity to lie on the surface of the water, as if to bask itself in the sun) frequents our seas during the warm summer months, and is not uncommon on the Welsh and Scottish coasts, where they come in shoals usually after intervals of a certain number of years. In the intervening summers, those that are seen on the Welsh coast are generally single fish, that have probably strayed from the rest. They appear in the Firth of Clyde, and among the Hebrides about mid-summer, in small droves of seven or eight, or more commonly in pairs. Here they continue till the latter end of July, when they disappear.

The food of these sharks seems to consist entirely of marine plants and some of the species of Medusæ. They swim very deliberately, and generally with their upper fins above water. Sometimes they may be seen sporting about among the waves, and leaping several feet above the surface.

The natives of our northern coasts are very alert in the pursuit, and very dexterous in the killing of these fish. When pursued, they do not accelerate their motion till the boat comes almost in contact with them, when the harpooner

Amazing rapidity when wounded.

strikes his weapon into the body as near the gills as he can. They seem not very susceptible of pain; for they often remain in the same place till the united strength of two men is exerted to force the harpoon deeper. As soon as they perceive themselves wounded they plunge headlong to the bottom; and frequently coil the rope round their bodies in agony, attempting to disengage themselves from the fatal instrument by rolling on the ground. Discovering that these efforts are in vain, they swim off with such amazing rapidity, that one instance has occurred of a basking shark towing to some distance a vessel of seventy tons burthen against a fresh gale. They sometimes run off with two hundred fathoms of line, and two harpoons in them; and will employ the men from twelve to twenty-four hours before they are subdued. As soon as they are killed, the fishermen haul them on shore; or, if at a distance from land, to the vessel's side, to cut them up and take out the liver, which is the only useful part of their bodies. This is melted into oil in kettles provided for the purpose; and, if the fish be a large one, it will yield eight barrels or upwards.

THE STURGEON.

THOUGH this large and fine-tasted fish is of a form terrible to view, it is perfectly harmless; the body, which is from six to eighteen feet in length, is pentagonal, armed from head to tail with five rows of large bony tubercles, each of which ends in a strong recurved tip; one of these is on the back, one on each side, and two on the margin of the belly. The snout is long, and obtuse at the end, and has the tendrils near the tip. The mouth, which is beneath the head, is somewhat like the opening of a purse, and is so formed as to be pushed suddenly out, or retracted. The upper part of the body is of a dirty olive colour; the lower part silvery; and the tubercles are white in the middle. The tendrils on the snout, which are some inches in length, have so great a resemblance in form to earth-worms that, at first sight, they might be mistaken for them. By this contrivance, this clumsy toothless fish is supposed to keep himself in good condition, the solidity of his flesh evidently showing him to be a fish of prey. He is said to hide his large body among the weeds near the sea-coast, or at the mouths of large rivers, only exposing his tendrils, which small fish or sea-insects, mistaking for real worms, approach for plunder, and are sucked into the jaws of their enemy. He has been supposed by some to root into the soil

Where found—Propensity for leaping.

at the bottom of the sea or rivers; but the tendrils above mentioned, which hang from his snout over his mouth, must themselves be very inconvenient for this purpose; and as he has no jaws, he evidently lives by suction, and, during his residence in the sea, marine insects are generally found in his stomach. From its quality of floundering at the bottom of rivers, the sturgeon has received its name (as Johnson observes) from the Germans, the word *stoeren* signifying to wallow in the mud.

Sturgeons are found both in the European and American seas. At the approach of spring, they leave the deep recesses of the sea, and enter the rivers to spawn; and from May to July the American rivers abound with them. "Here," says Catesby, "they are often observed to leap to the height of several yards out of the water, which they do in an erect position, falling back again on their sides with such noise as to be heard in the still evenings to a great distance. They have often been known, at these times, to fall into the small boats or canoes of the Indians, and sink them. On this account it is often dangerous to pass the places that are much frequented by them; many instances have occurred of people losing their lives by this means. Some of the Indians take advantage of this propensity for leaping to catch them, by stationing themselves in tolerably large boats in the places where they are seen, and receiving them as they fall."

Caught in nets—How killed by the Indians.

As sturgeons are not voracious fish, they are never caught by baits, but in nets composed of small cords, and placed across the mouth of the river, but in such a manner, that whether the tide ebbs or flows, the pouch of the net goes with the stream. In some rivers of Virginia, the sturgeons are found in such numbers that six hundred have been taken in two days, with no more trouble than putting down a pole, with a hook at the end, to the bottom, and drawing it up again, on feeling it rub against a fish. They are, however, chiefly killed in the night with harpoons, attracted by the light of torches made of the wood of the black pine. On the shores are frequently seen the bodies of sturgeons that have been wounded with the spears, and have afterwards expired.

The Indians often kill them in the lakes in the day-time. For this purpose there are usually two men in a canoe, one at the stern to work it forward, and the other at the head, with a pointed spear about fourteen feet long, tied to a long cord that is fastened to one of the cross timbers of the canoe. The moment a sturgeon is seen within reach, the man at the head darts his spear into the tenderest part of the body that he can reach; and if it penetrate, the fish swims off with astonishing velocity, dragging the canoe along the water after it. If, however, the blow be pretty well aimed, the fish does not go more than two or three hundred yards before he

dies; when the men draw up the line and take him. Sometimes, when sturgeons are seen to lie at the bottom of the still water near the cataracts, they are struck with a spear without a rope, their place being marked, on their rising, by the appearance of the shaft above the water.

Sturgeons annually ascend our rivers, in the summer, particularly those of the Eden and Esk, but in no great numbers. It is so spiritless a fish that, when caught by accident, as it sometimes is, in the salmon nets, it scarcely makes any resistance, but is drawn out of the water apparently lifeless. One of the largest ever caught in our rivers which weighed four hundred and sixty pounds was taken in the Esk, about thirty years ago. In 1758 one was taken in Italy, which weighed five hundred and fifty pounds, and was presented by the Duke Carpenetto to the Pope. Pontoppidan asserts, that in Norway the head of one only sometimes furnishes a ton of oil, and that some have been caught there weighing one thousand pounds.

The fecundity of these fish is exceedingly great. Catesby says, that the females frequently contain a bushel of spawn each; and Leeuwenhoek found in the roe of one of them no fewer than 150,000,000,000 eggs. The flesh is well known to be extremely delicious, greatly resembling veal; and it was so much valued, in the time of the Emperor Severus, that it was brought to table by servants with coronets on their heads,

Modes of pickling the sturgeon.

and preceded by music. This might give rise to its being, in our country, presented by the lord mayor to the king. At present, the sturgeons are caught in the Danube, the Wolga, the Don, and other large rivers, for various purposes.

When pickled, the flesh of the sturgeon is more prized in England than in any of the countries where it is usually caught. The fishermen have two different methods of preparing it: the one is by cutting them in long pieces length-ways, and having salted them, by hanging them up in the sun to dry: thus prepared, the fish is sold in all the countries of the Levant, and supplies the want of better provisions.

The other method, which is generally practised in Holland, and along the shores of the Baltic, is to cut the sturgeon cross-ways, into short pieces, and put it into small barrels, with a pickle made of salt and saumure; and in this manner it is generally sold in England.

There is a celebrated epicurean food also prepared from the hard roe of the sturgeon, under the appellation of *caviare*, formed into small cakes. It is made by freeing the spawn from the little fibres by which it is connected, and which is washed in white wine, or vinegar, and afterwards spread out to dry. It is then put into a vessel and salted (crushing it down with the hands) and afterwards inclosed in a canvas bag to drain off the moisture. It is last of all, put into a tub with a hole in the bottom, that

any remaining moisture may run off, pressed down and closed for use.

The bones of the sturgeon are reported to be so hard as to serve the American Indians for rasps and nutmeg-graters. The skin makes a good covering for carriages.

The sterlet is distinguished from the common sturgeon by having only three rows of bony scales, one down the back and one on each side. The plates do not project so much, and are less curved than those of the sturgeon.

This fish is found in great abundance in the Caspian sea, the Wolga and Jaik. It is the smallest of all the species of sturgeons; seldom exceeding four feet in length, and thirty-five pounds in weight. Bruyne asserts, that it is the most delicate fish of Russia. The caviare made from its eggs is of such superior quality, that it is reserved for the use of the imperial family. This fish spawns in May or June. In August it returns to the Caspian, which it leaves again in spring, and ascends the Wolga, Jaik, and other rivers that discharge themselves into it. It multiplies very fast, feeds upon worms and young fish, but principally on the eggs of the sturgeon, which it follows for this reason. Its flesh is white, tender, and easy of digestion, and consequently affords a wholesome food for sickly persons.

There is another sort of sturgeon, distinguished

The buthenus—Huso.

by fifteen scaly protuberances, a native of Russia, and called buthenus, in the technical language of Linnæus, but is probably the caviare sturgeon of other writers.

The huso is a fish very much resembling the sturgeon, and classed by Linnæus under the same genus, (accipencer :) it is a native of Russia and the Danube; the body is naked, that is, it has no protuberances; grows frequently to twenty-four feet in length, and the skin is so tough and strong, that it is employed for ropes, in carts and other wheel carriages. Its flesh is soft, glutinous and flabby; but when salted acquires a better taste, and turns red like salmon: it is caught from October to January, and weighs from seventy pounds to almost four hundred; but is chiefly taken for the purpose of furnishing that useful commodity isinglass, so famous as an agglutinant in medicine, as well as for the fining of wines; for both which uses, it appears that this fish was known to the ancients. The Rev. Mr. Bingley and others deny, that any part of the sturgeon will produce this commodity except the inner coat of its air-bladder. They say, the isinglas most common in our shops is made from a species of dolphin called the beluga, an account of which, the reader will find in our description of the dolphin.

The art of making isinglass was long a secret in the hands of the Russians; but has lately been

discovered, and the following account of it published by Humphrey Jackson, Esq. in the Philosophical Transactions.

“ All authors, who have hitherto delivered processes for making isinglass, have greatly mistaken both its constituent matter and preparation.

“ In my first attempt to discover the constituent parts and manufacture of isinglass, relying too much upon the authority of some chemical authors, whose veracity I had experienced in many other instances, I found myself constantly disappointed. Glue, not isinglass, was the result of every process; and although in the same view, a journey to Russia proved fruitless, yet a steady perseverance in the research proved not only successful as to this object, but, in the pursuit, to discover a resinous matter plentifully procurable in the British fisheries, which has been found by ample experience to answer similar purposes.

“ It is now no longer a secret that the lakes and rivers in North America are stocked with immense quantities of fish, said to be the same species with those in Muscovy, and yielding the finest isinglass; the fisheries whereof, under due encouragement, would doubtless supply all Europe with this valuable article.

“ No artificial heat is necessary to the production of isinglass; neither is the matter dissolved for this purpose; for, as the continuity of its fibres would be destroyed by solution, the mass

Humphrey Jackson's remarks

would become brittle in drying, and snap short asunder, which is always the case with glue, but never with isinglass.

“The latter, indeed, may be resolved into glue with boiling water; but its fibrous recomposition would be found impracticable afterwards, and a fibrous texture is one of the most distinguishing characteristics of genuine isinglass.

“The sounds, or air bladders, of fresh-water fish in general, are preserved for this purpose, as being the most transparent, flexible, delicate substances. These constitute the finest sorts of isinglass; those called book and ordinary staple, are made of the intestines, and probably of the peritonæum of the fish. The beluga yields the greatest quantity, as being the largest and most plentiful fish in the Muscovy river; but the sounds of all fresh-water fish yield more or less fine isinglass, particularly the smaller sorts, found in prodigious quantities in the Caspian Sea; and several hundred miles beyond Astracan, in the Wolga, Yoik, Don, and even as far as Siberia, where it is called, *kle*, or *kla*, by the natives, which implies a glutinous matter; it is the basis of the Russian glue, which is preferred to all other kinds for its strength.

“Isinglass receives its different shapes in the following manner:

“The part of which it is composed, particularly the sounds, are taken from the fish, while sweet and fresh, slit open, washed from their

slimy *sordes*, divested of every thin membrane which envelopes the sound, and then exposed to stiffen a little in the air. In this state they are formed into rolls about the thickness of a finger, and in length according to the intended size of the staple: a thin membrane is generally selected for the centre of the roll, round which the rest are folded alternately, and about half an inch of each extremity of the roll is turned inwards. The two dimensions being thus obtained, the two ends of what is called *short staple*, are pinned together with a small wooden peg: the middle of the roll is then pressed a little downwards, which gives it the resemblance of a heart shape; and thus it is laid on boards, or hung up in the air to dry. The sounds, which compose the long staple, are longer than the former; but the operator lengthens this sort at pleasure, by inter-folding the ends of one or more pieces of the sound with each other. The extremities are fastened with a peg like the former, but the middle part of the roll is bent more considerably downwards; and, in order to preserve the shape of the three obtuse angles thus formed, a piece of round stick, about a quarter of an inch diameter, is fastened in each angle with small wooden pegs in the same manner as at the ends. In this state it is permitted to dry long enough to retain its form, when the pegs and sticks are taken out, and the drying completed; lastly, the pieces of isinglass are colligated in rows, by running pack-

Jackson's remarks.

thread through the peg-holes for convenience of package and exportation.

“ The membranes of the *book* sort being thick and refractory, will not admit a similar formation with the preceding; the pieces, therefore, after their sides are folded inwardly, are bent in the centre, in such a manner that the opposite sides resemble the cover of a book, from whence its name, a peg being run across the middle, fastens the sides together, and thus it is dried like the former. This sort is interleaved, and the pegs run across the ends, the better to prevent its unfolding.

“ That called cake isinglass, is formed of the bits and fragments of the staple sorts, put into a flat metalline pan, with a little water, and heated just enough to make the parts cohere like a pancake, when it is dried; but frequently it is overheated, as such pieces, as before observed, become useless in the business of fining. Experience has taught the consumer to reject them.

“ It has long been a prevalent opinion, that sturgeon, on account of its cartilaginous nature, would yield great quantities of isinglass; but, on examination, no part of this fish, except the inner coat of the sound, promised the least success. This being full of *ruga*, adheres so firmly to the external membrane, which is useless, that the labour of separating them supersedes the advantage. The intestines however, which in the

Jackson's remarks.

larger fish extend several yards in length, being cleansed from their mucus, and dried, were found surprisingly strong and elastic, resembling cords made with the intestines of other animals, commonly called cat-gut, and from some trials, promised superior advantages, when applied to mechanic operations."



CHAP. V.

The hook'd torpedo ne'er forgets his art,
But soon as struck begins to play its part;
And to the line applies his magic sides:
Without delay the subtile power glides
Along the pliant rod and slender hairs,
Then to the fisher's hand as swift repairs:
Amaz'd he stands, his arms of sense bereft,
Down drops the idle rod,—his prey is left:

JONES'S OPIAN:

THE TORPEDO.

THERE are about twenty species of the ray, of all which the torpedo, or electric ray, is the most remarkable, as it possesses some very distinguishing peculiarities. In the general structure of its body it has not been found to differ materially from the rest of the rays. The electric organs are placed one on each side of the cranium or gills, reaching from thence to the semi-circular cartilages of each great fin, and extending longitudinally from the anterior extremity of the animal to the transverse cartilage which divides the thorax from the abdomen, and

Number of columns in each organ various.

within these limits they occupy the whole space between the skin of the upper and under surfaces. Each organ is attached to the surrounding parts by a close cellular membrane, and also by short and strong tendinous fibres, which pass directly across from its outer edge to the semi-circular cartilages. They are covered above and below with the common skin of the animal, under which are longitudinal fibres spread entirely over them. Each organ is about five inches in length, and at the anterior end about three in breadth. They are composed of perpendicular columns, reaching from the upper to the under surface, varying in length according to the thickness of the parts of the body, from an inch and a half to half an inch; and their diameters are from a fourth to a fifth of an inch. The coats of the columns are very thin, and almost transparent. The number of columns in each organ varies considerably in different animals. That of one that Mr. Hunter presented to the Royal Society was about four hundred and seventy; but in a very large torpedo the number of columns in one organ was 1182. These columns were composed of films parallel to the base of each, and the distance between each of the columns were one hundred and fiftieth part of an inch.

“If,” remarks Mr. Hunter, (Phil. Trans.) “we suppose these films to be charged with electricity, and to be the 300th part of an inch

Remarks by Mr. Hunter.

thick, and a middling-sized torpedo to contain in both organs, on the whole, 1000 columns each an inch long, and 0.03 square inches area at the base, then $1000 \times 150 \times 0.3 = 4500$ square inches. Now it has been clearly proved that the capacity of stout glass is thirty-six times less than that of these organs; therefore both the organs of a middling-sized torpedo will be equivalent to $4500 \times 36 = 162,000$ square inches, or 1125 square feet of glass.—The nerves inserted into each organ arise by three very large trunks from the lateral and posterior part of the brain. These, having entered the organs, ramify in every direction between the columns. The number and magnitude are extremely great; and it is supposed that they are subservient to the formation, collection, and management of the torpedinal fluid."

The head and the body of the torpedo are indistinct from each other, and nearly of a circular form, two or three inches thick in the middle, attenuating to extreme thinness on the edges. The skin is smooth, of a dusky brown colour above, and white underneath. The ventral fins form on each side, at the end of the body, nearly a quarter of a circle. The tail is short, and the two dorsal fins are placed near its origin. The mouth is small, and, as in the other species, there are on each side below it five breathing apertures.

The electric rays are found in many of the European seas, and the fishermen often discover

Extraordinary toporific quality.

it in Torbay, and sometimes of such a size as to weigh eighty pounds. They are partial to sandy bottoms, in about forty fathoms of water, where they often bury themselves by flinging the sand over them, by a quick flapping of all the extremities. In Torbay they are generally taken like other flat-fish, with the trawl-net; and instances have occurred of their seizing a bait. They bring forth their young in the autumn.

This fish's benumbing or toporific quality is one of the most potent and extraordinary faculties in nature. The ignorant stranger might imagine he is only handling a skate, when he is instantly struck numb.

Upon touching the torpedo with the finger, it frequently, though not always, happens, that the person feels an unusual pain and numbness, which suddenly seizes the arm up to the elbow, and sometimes to the very shoulder, or head. The pain is of a very particular species, and not to be described by any words; yet Lorengini, Berelli, Rhedi, and Rheaumur, who all felt it severely, observe it to bear some resemblance to that painful sensation felt in the arm upon striking the elbow violently against a hard body; though Rheaumur assures us that this gives but a very faint idea of it.

Its chief force is at the instant it begins; it lasts but a few moments, and then vanishes entirely. If a man do not actually touch the torpedo, how near soever he holds his hands, he

Rheumur's exposition.

feels nothing:—if he touch it with a stick, he feels a faint effect:—if he touch it through the interposition of any pretty thin body, the numbness is felt very considerably; if the hand be pressed very strong against it, the numbness is the less, but still strong enough to oblige a man speedily to let go.

Rheumur accounts for this phenomenon in the following manner: the torpedo, like other flat-fish, is not absolutely flat; but its back, or rather all the upper parts of its body, a little convex: when it did not, or would not produce any numbness in such as touched it, its back he found, always preserved its natural convexity; but whenever it would dispose itself to resent a touch, or thrust, it gradually diminished the convexity of the back parts of the body, sometimes only rendering them flat, and sometimes concave. The next moment the numbness always begins to seize the arm; the fingers that touched were obliged to give back, and the flat and concave part of the body was seen again convex, and where as it only became flat insensibly, it returned to its convexity so swiftly that one could not perceive any passage from the one to the other state.

The motion of a ball out of a musket is not perhaps much quicker than that of the fish re-assuming its situation; at least the one is not more perceivable than the other. It is from this sudden stroke that the numbness of the arm arises; and accordingly the person, when he be-

gins to feel it, imagines that his fingers have been violently struck. Rheumur adds, that the single stroke of a soft body could never effect this; but in the present case there is an infinity of strokes given in an instant. When the torpedo is ready to strike its numbness, it slowly flattens the outer surface of its upper part, and the whole mechanism, which its force depends, will be apparent. By that gradual contraction it bends, as it were, all its springs, renders all its cylinders shorter, and at the same time augments their basis. But the contraction being made to a certain degree, the springs again unbend; and if a finger then touch the torpedo, it instantly receives a stroke which shakes the nerves, suspends, or changes the course of the animal spirit: or, if the idea be more distinct, these strokes produce an undulatory motion in the fibres of the nerves, which clashes; or disagrees, with what they should have in order to move the arm; and hence the inability we are under of using the same, and the painful sensation which accompanies it. Hence it is, also, that the torpedo does not convey its numbness to any degree except when touched on these great muscles; so that the fish is very safely taken by the tail, which is the part by which the fishermen catch it.

Lorenzini and others, have endeavoured to account for the effect of the torpedo from toporific effluvia: this Rheumur objects to with a variety

Painful sensations arising from

of ingenious arguments; and especially observes, that the torpedo conveys its numbness to the hand through a hard solid body, but does not do it through the air.

From Rheumur's experiments, it is evident that the torpedo numbs the hand of him that touches it, by an effort. From what Kempfer relates, as well as by all other accounts, the shock received most resembles the stroke of an electrical machine; sudden, tinkling and painful: the shocks are entirely similar, the duration of the pain is the same: yet still it exceeds all human knowledge how the electric matter is originally procured, how the animal contrives to renew the charge, or how it is prevented from evaporating it on contiguous subjects.

"The instant," says Kempfer, "I touched it with my hand, I felt a terrible numbness in my arm, and as far up as my shoulder. Even if one tread upon it with the shoe on, it affects not only the leg, but the whole thigh upwards. Those who touch it with their foot are seized with a stronger palpitation than even those who touch it with the hand. This numbness bears no resemblance to that which we feel when a nerve is a long time pressed, and the foot is said to be asleep; it rather appears like a sudden vapour, which, passing through the pores in an instant penetrates to the very springs of life, from whence it diffuses itself over the whole body, and gives real pain. The nerves are so affected, that

The baneful powers of this fish.

the person struck, imagines all the bones of his body, and particularly those of the limb that received the blow, are driven out of joint. All this is accompanied with an universal tremor, a sickness of the stomach, a general convulsion, and a total suspension of the faculties of the mind.

“In short,” continues our author, “such is the pain, that all the force of our promises and authority could not prevail upon a seaman to undergo the force of a shock a second time. A negro, indeed, that was standing by, readily undertook to touch the torpedo, and was seen to handle it without feeling any of its effects. He informed us, that his whole secret consisted in keeping in his breath: and we found, upon trial, that this method answered with ourselves.”

The baneful powers of this fish are known to decline with its vigour; as its strength ceases, the force of the shock seems to diminish, till at last, when the fish is dead, the whole power is destroyed, and it may be handled or eaten with perfect security. Though when first taken out of the sea, its force is very great, and not only affects the hand, but even if touched with a stick, the person sometimes feels himself affected. This latent power is said to be more extensive in the female than the male.

Dr. Ingenhouz had a torpedo for some time in a tub of sea-water, which, from its being during winter, seemed to be feeble. On taking it into

Experiments by Dr. Ingenhouz and Mr. Walsh.

his hands, and pressing it on each side of the head, a sudden tremor, which lasted for two or three seconds, passed into his fingers, but extended no further. After a few seconds the same trembling was felt again; and again several times, after different intervals. The sensation was, he says, the same that he should have felt by the discharge of several very small electrical bottles, one after another, into his hand. The shocks sometimes followed each other very quickly, and increased in strength towards the last. Probably, from the weakness of the fish, the shock could not be communicated through a brass chain, though the usual contortion was evidently made. A coated vial was applied to it, but could not be charged.

It appears, from some experiments that were made by Mr. Walsh on a very stout and healthy fish, that, although it seemed to possess many electric properties, yet, no spark whatever could be discovered to proceed from it, nor were pith-balls ever found to be affected by it. When it was insulated, it gave a shock to persons likewise insulated, and even to several that took hold of each other's hands: this it did forty or fifty times successively, and with very little diminution of force. If touched only with one finger, the shock was so great as to be felt in both hands. Each effort was accompanied by a depression of the eyes, which plainly indicated the attempts that were made upon non-conductors. Although

Description.

the animal was in full vigour, it was not able to force the torpedinal fluid across the minutest tract of air, not even from one link of a small chain freely suspended to another, nor through an almost invisible separation made by a pen-knife in a slip of tinsoil pasted on sealing-wax.

FIRE FLARE, OR STING RAY.

THE fire flare, which is the dread of the boldest and most experienced fishermen, has quite a smooth body, and of a shape almost round, much thicker and of a more elevated form in the middle than any other rays, but grows very thin towards the edges. The nose is very sharp pointed, but short; the mouth small, and filled with granulated teeth. The tail is very thick at the beginning, and has a spine about one-third of the length of the tail from the body; this spine is about five inches long, flat on the top and bottom, very hard, sharp pointed, and the two sides thin, and closely and sharply bearded the whole way. The tail extends four inches beyond the end of the spine, and grows very slender at the extremity.

The Greek and Roman writers of ancient times, with the exception of Aristotle, have given a very terrible description of the spine of the sting ray. Ælian and Pliny assert, that there is no cure for a wound inflicted by it. The former

Singular property of the spine.

relates, that a thief, who had stolen one of these fish, which he took for a plaice, was wounded by its spine, and instantly dropped down dead. The enchantress Circe, it is said, armed her son with a spear, headed with the spine of the sting ray, as the most irresistible weapon she could furnish him with; and he afterwards unintentionally slew with it his father Ulysses. Notwithstanding the dreadful effects attributed to this formidable weapon, the fishermen of Heiligoland, according to Schoneveld, entertain no apprehension of it; and Kempfer informs us, that those of Japan consider it the most certain remedy against the bite of a serpent, if rubbed upon the wound; they, therefore, always carry one about them. But this property is only possessed by such spines as are cut from the animals when alive. Even modern naturalists, (among whom is the celebrated Linnæus) think the spine of this fish venomous: Dr. Bloch, however, ventures to differ from them in this opinion, and asserts, that the wound inflicted by the spine of the sting ray is not more dangerous than that of any other similar instrument. This spine is employed by the fish, not only as a weapon of defence, but to wound other fish with it, in order the more easily to seize and devour them. According to Pliny, he is enabled by it to make himself formidable even to the shark.

The wound that is inflicted by an animal's tail has, no doubt, something terrible in the idea,

Capable of inflicting a terrible wound.

and may from thence alone be supposed to be fatal; terror might add poison to the pain, and call up imaginary danger; hence the negroes universally believe that the sting is poisonous: yet they never die in consequence of the wound, and the simplicity and slightness of the remedy sufficiently argue the innoxiousness of the wound; for by opening the fish, and laying it to the part injured, it effects a speedy cure. Hence there is sufficient cause to declare against its venomous qualities, notwithstanding the assertions of most of the fishermen, and the opinion of some men of learning: the spine of the ray seems to be in fact a weapon of offence, capable of inflicting a very terrible wound, and attended with very dangerous symptoms; but not possessed of any degree of poison. The spine has no sheath to preserve the supposed venom on its surface; nor has the animal any gland that separates the noxious fluid. It is fixed to the tail as a quill is into the tail of a fowl, and is annually shed in the same manner; it may therefore be necessary for the creature's defence, but cannot be necessary for its existence.

Spears and darts, says Mr. Pennant, might in very early times have been headed with the spine of the fire flare, instead of iron. Even in the present day it is used by some of the American tribes to point their arrows.

The fire flare is found in almost all the Euro-

One examined by Mr. Pennant described.

pean seas, the Eastern and American; it does not arrive at the bulk of the other species of rays. Mr. Pennant says, that which he examined was two feet nine inches from the tip of the nose to the end of the tail; to the origin of the tail one foot three inches; the breadth one foot eight. The colour of the upper part of the body is a dirty yellow, the middle part of an obscure blue; the lower side white, the tail and spine dusky. The sting ray is observed to shed its spine annually; sometimes the new one appears before the old spine has dropped off, which gives the fish the appearance of having three tails.

*THE THORNBACK, ROUGH RAY,
SKATE, &c.*

THE thornback, or prickly ray, has its spines disposed in three rows upon the back; a transverse cartilage in the belly; the head and body very flat and depressed; the figure of the body, exclusive of the tail, is nearly square; the tail long and slender, but a little depressed or flattened; the belly altogether plain, but rising a little in the middle into a convexity; the eyes stand on the uppermost part of the body, at a considerable distance from the beak, are a little protuberant, and covered with a simple naked skin; the mouth is situated on the under side of the body, and lies

in a transverse direction; is very large, and stands at the same distance from the extremity of the beak as the eyes do.

The rough ray has its spines spread indiscriminately over the whole back.

The sharp-nosed ray has ten spines that are situated towards the middle of the back.

The skate has the middle of the back rough, and a single row of spines on the tail. This is a well-known fish, long and flat, if not caught before his full growth, when he is from five to six feet in length. His skin is black, and so very hard and rough, that it is often employed in polishing wood and ivory like the skin of a sea-dog. This fish is extremely voracious, and armed with terrible teeth; nevertheless he has recourse to stratagem in catching his living food, by concealing himself under the sands. The French make of its ashes an excellent soap for a certain cutaneous disease which is generally cured by sulphur, and by them called *Savon d'Ange*. Pliny attributes to the flesh of this fish a singular virtue, when applied fresh to the necks of women,—that of preventing them from growing too large: it is certain it was very much used by the Romans: and Rondelet, one of the first naturalists of the sixteenth century, assures us, that he tried the experiment with success.

It is well known that the English fishermen have often caught ray-fish that have weighed

Labat's account of a prodigious ray.

above two hundred pounds: and yet that weight is trifling, compared to their enormous bulk in other parts of the world. Among many instances we need only adduce the account given by Labat of a prodigious ray, speared by the negroes at Guadaloupe.

“This fish,” says he, “was thirteen feet eight inches broad, and above ten feet from the snout to the insertion of the tail, which was itself in proportion, being no less than fifteen feet long, twenty inches broad, at its insertion, and tapering to a point. The body was two feet in depth: the skin as thick as leather, and marked with spots, which spots in all of this kind, are only glands that supply a mucus to lubricate and soften the skin. This enormous fish was utterly unfit to be eaten by Europeans; but the negroes chose out some of the nicest bits, and carefully salted them up as a most favourite provision.”

The ray-fish generate in May and April, and the females are prolific to an extreme degree; no less than three hundred eggs having been taken out of the body of a single ray, covered with a tough horny substance, which they acquire in the womb, by the concretion of the fluids of that organ. When come to maturity, they are excluded, only one at a time, at intervals of three or four hours. These eggs, or purses, as the fishermen call them, are usually

Industry of Dutch fishermen.

cast about the beginning of May, and they continue casting most part of the summer.

When the breeding time ceases, which is about October, they are become very poor and thin; but they soon begin to recover, and gradually increase in goodness until the following May, when they have reached the highest state of perfection.

The Dutch fishermen, who are indefatigable in their pursuits, begin their operations very early in the winter, in which the English succeed them, but seldom with equal success. The method is by lines, and is certainly fatiguing and dangerous; but the value of the capture generally repays the pain. The skate and thornback are very marketable articles, good food, and their weight, which is from ten to two hundred pounds weight, amply repays the trouble,

THE SEA ORB.

THE general marks of this creature are, that its figure is almost round; that it has a mouth like a frog, and is from seven inches to two feet long. It is covered with long thorns, which point on every side; and when the animal is enraged, it can blow up its body as round as a bladder. There are several varieties of this unshapely and extraordinary creature. Some

Varieties—Formidable and generally venomous.

threaten only with their spine; others are defended with a bony helmet that covers the head; some with a coat of mail from the head to the other extremity; and others again armed offensively and defensively with bones and spines. Their armour is in all cases formidable, and the greater number of them venomous in their nature.

The centriscus includes two species; one having its back covered with a smooth bony shell, which ends in a sharp spine, under which is the tail. It is a native of the East Indies. The other, which is found in the Mediterranean, has a rough scabrous body, and a straight extended tail. In both, the head gradually ends in a narrow snout, the aperture is broad and flat; the belly keel-formed, and the belly-fins united. It wounds with its fins.

The ostracion cornutus is found in the Indian Ocean; it has a long spine in front of each eye, and one on each side the vent, pointing to the tail; the body quadrangular, reticulated with a raised line; the tail very long.

The five-spined coney fish is also supposed to be an inhabitant of the Indian Ocean. The body is triangular, and retriangulated by sunk lines into hexangular and heptangular meshes, each bound a little within the line by a black stripe; before each eye a short strong spine; a third on the middle of the back, and one on each side the

Five-spined coney fish—Old wife.

belly near the vent; the body from the vent to the tail covered with a soft smooth skin; the tail round at the end.

This genus has, probably, the power of drawing the defenceless parts under the bony coat of the body at the approach of danger. It seems necessary that the parts of the body to which the fins are attached, should be covered with a pliable skin, especially that part of the body near the tail; as fish move forward less with the assistance of their fins, than by the motion of their body sideways; which is exemplified in the common method of impelling a cock-boat, by moving sideways an oar at the helm.

The old wife, (a native of the above sea) is of a triangular body, the back sharp; the bony coat on the head and body divided by striæ into many hexangular meshes: the areas rough with numerous granule, ranged in concentric lines; the skinny cover of the body near the tail, and tail fin, marked with largish spots; a strong spine on each side the belly, pointing towards the tail.

A fish, apparently the same as the above, except that it has an oval crust upon its tail, is mentioned among the rarities preserved in Gresham College.

These animals display as much variety in their size as in figure; some are not bigger than a foot-ball, and others as large as a bushel; and when enraged, can inflate to a considerable de-

Abhorrent figure of all the species.

gree, and become as round as a globe. They can flatten and erect their spines at pleasure, and increase the terrors of their appearance in proportion to the approach of danger: for on being provoked or alarmed, the body that before seemed small, swells to the view, the animal visibly increases in size, its prickles stand erect, and threaten the invader on every side. They are often caught by the Americans, merely for the barren pleasure of destroying them. They bait a line and hook with a piece of sea crab, which the ostracion approaches with flattened spines; but on feeling its mistake, rage takes possession of the creature, the spines become erect, and it is effectually armed at all points, that no one dare venture to lay hold of it, but they drag it to some distance from the water, where it soon expires.

A kind of bag or bladder filled with air is found in the belly of most of these animals, by the inflation of which the animal swells itself in the manner above-mentioned.

The figure of the sea orb, and all its species is so very abhorrent, that scarce any one would wish to experience them as food, in which case, however, they are absolutely poisonous. The natives of these countries where they are found, humanely and carefully inform strangers of their danger: yet the admonition was lost upon a certain sailor at the Cape of Good Hope, who not

Description.

relying on what the Dutch had told him, was resolved to make the experiment, and break through a prejudice which he supposed was founded on the animal's deformity. He tried and ate one, but his rashness cost him his life; he instantly fell sick, and died a few days after.

THE ANGEL SHARK.

THIS is unlike the common sharks, being distinguished by its flat body, which forms the connecting link, as it were, between the genus of rays and that of sharks, as it partakes of the figure of both. The head is of a circular form, and rather broader than the body. The mouth is wide, and is situated at the extremity of the head. Like the sharks, the old fish of this species have more teeth than the young ones. Thus two angel sharks, only a foot long, in the possession of Dr. Bloch, had only two rows of teeth in the upper jaw, and three in the lower; while Willoughby and Rondelet assert, that there are three in the former, and five in the latter. The fins are large and wide, and their resemblance to wings has probably procured this fish the denomination of angel. Of a certain portion of the skin the Turks make the most

beautiful shagreen for watch-cases, and in Italy it is used for polishing wood and ivory.

It is asserted by Aristotle, that the angel-shark possesses the property of changing colour, and of assuming that of the fish which it is about to seize; this, however, is equally unfounded with his assertion, that in imminent danger the female receives her young into her body. It is more probable, as Oppian relates, that she covers them with her fins for the purpose of affording them protection. According to Rondelet, the eggs of this fish when reduced to powder are a sovereign remedy for diarrhœa: for though the angel-shark produces her young alive, she belongs to that class of cartilaginous fish, which hatch their eggs within their own bodies, whence the young are excluded when they arrive at a proper state of maturity.

In spring and autumn the female usually produces seven or eight young ones, and Gronovius asserts, that she sometimes has thirteen, which are upwards of eight inches in length. The flesh of this fish is bad, and is bought only by the lowest classes of the people on the Mediterranean coasts.

The angel-shark is found in the Mediterranean and German Ocean. On the English coasts it is frequently caught of the weight of one hundred pounds, and in the Mediterranean of one hundred and sixty. In the Dutch seas it is

Description.

sometimes found of enormous magnitude. It attains the length of six or eight feet, and belongs to the class of voracious fish. As it usually resides at the bottom of the ocean, it principally preys upon plaice and rays, which are often found in its stomach. It is bold enough even to attack men, and Pennant relates that a fisherman who had taken one in his net was severely wounded, in consequence of imprudently venturing too near it. It is caught by a hook baited with flesh.

THE SPOTTED DOG-FISH.

THE spotted dog-fish, which belongs to the family of sharks, is long and slender, round in the middle, and flat towards the tail. The head is small, and ends in a short blunt point. The tail is long, and the mouth very large. Its jaws are furnished with three rows of sharp-pointed teeth; the palate is rough, as well as the tongue, which is cartilaginous. Close behind the eyes are the aqueous apertures, and near these are the openings of the gills. The anus is between the ventral, or belly fins, where are also situated two cartilaginous substances. As these are found only in the males, naturalists have imagined them to be the sexual members; but Dr. Bloch, who dissected them with great care, (and to whose indefatigable perseverance the science is

Voracity—How taken—Tenacious of life.

greatly indebted) discovered them to be a kind of hands. They are composed of two bones, and a long cartilage, which can be removed from each other by means of the muscles, as in the rays.

The dog-fish inhabits both hot and cold climates; it is found in the British and Norwegian seas, in the Mediterranean, at the Canary Islands, the Cape of Good Hope, and at the Line. It grows to the length of five or six feet, and is one of the voracious class of fish, which are formidable even to man, whom it ventures to attack; for which reason, the sailors when they bathe, take precautions to preserve themselves from its rapacity. Osbeck relates, that in the stomach of a dog-fish he found several hens, with their feathers, which had been thrown overboard, besides a number of bonitos.

This fish is taken with strong cords, to which are fastened hooks baited with a piece of bacon, or a hen. It is so tenacious of life, that after the head and tail are cut off, and the entrails taken out, the body continues to move for an hour. The flesh is hard and oily; for this reason it is eaten only in cases of necessity, and when the fish is young. It is cut in slices, and soaked in water till the oil is extracted, which may be known by the grease ceasing to float on the surface of the water. Its skin is used for polishing by cabinet-makers.

The dog-fish is of the viviparous kind, and

Descriptions.

nine or ten young ones are said to have been found in the belly of the female. She excludes them one at a time, and the fishermen declare that she is always pregnant. According to Pennant, the females are much larger than the males.

THE UNICORN.

THE head of the unicorn consists but of one ray; and we are told by Catesby, that the guts of this fish are full of small shells, and coraline substances, which, by the strength and hardness of its jaws, it is enabled to grind very small. They mostly frequent those seas among the Bahama Islands, where the corals are in greatest plenty. These fish are not eaten, being accounted poisonous.

THE LONG FILE FISH.

THE body of the long file fish is not very deep; the skin is divided by smooth furrows with small rough scale-like spaces: each of these on the sides have a small spine pointing towards the tail; the first dorsal fin has three spines, the first of which is very large and rough in front, like a file, and hence the English name; the third very short, and situated at a considerable

Singular property of the first dorsal fin.

distance from the other two; the skin of the back and belly at the base of the dorsal and anal fins drawn out and compressed; pectoral fins small; dorsal and anal fins triangular, and situate nearly opposite each other; the tail even at the end.

A singular property is possessed by the first dorsal fin of this fish, which is, that no force can depress the first spine; but if the last be depressed in ever so gentle a manner, the other two immediately fall down with it; and as instantaneously as when a cross-bow is let off by pulling the trigger. One sort, found in the Mediterranean, near Rome, is on that account called *pisce balestra*, (the cross-bow fish.)

There is another species mentioned by Walcott, the body of which is much compressed and deep; the rays of the first dorsal fin, spiny; the first ray very long and rough; first dorsal fin and the back from its base black; rest of the body and the head a golden yellow; skin rough; tail rough; and in the place of each ventral fin a long rough spine.

Also another species, (named *hispidus* by naturalists) is found in Carolina; the head fin of which is not radiated, and there is a round black spot in the tail fin. The body is rough, and bristly towards the tail. The spine, or horn, is situated between the eyes; and instead of a belly fin it has a jagged sharp spine.

Several more species, or varieties, are found

Description—Different Species.

in the Indian Ocean, and at Ascension Island, all which, together with the unicorn, go by the general name of the belistes.

THE SEA-HORSE.

THE head of the sea-horse bends towards its belly, and from its form, gives name to the animal, which never exceeds nine inches in length, and is about as thick as a man's thumb. The whole body seems to be composed of cartilaginous rings, on the intermediate membranes of which several prickles are placed. The snout is a kind of tube, with a hole at the bottom, to which there is a cover that the animal can open and shut at pleasure. Behind the eyes are two fins that look like ears; and above them are two holes that serve for respiration. The tail generally curls downward; along the ridges is a row of tubercles; the whole animal is speckled; and while alive it is said to have hair on the fore part of its body, which falls off when it is dead. This animal more resembles a sea-horse than a fish.

One species of this fish is common in the Mediterranean and Western Ocean; but in place of tubercles it has short spines. There is also another species, which is smooth, without spots, and is found in the Straits of Sunda, in the East Indies.

Singularity of its figure.

The ancients, probably impressed by the singularity of its figure, entertained an opinion that the sea-horse was exceedingly venomous. "On the sea-coast near Pozzuoli, in Italy," says a modern traveller, "are found certain little dried animals called cavalli marini, about the length of ones thumb; its head resembles a horse's, and its body terminates in a tail like that of a shrimp. The ladies make use of them to increase their milk."



CHAP. VI.

" Midst the tide
Two beauteous forms were seen to glide,
The genii of the stream;
Their scaly armour's Tyrian hue
Through richest purple to the view
Betray'd a golden gleam."

GRAY.

GOLD AND SILVER FISH.

THESE beautiful fish are a species of carp, and on account of their brilliant colours esteemed the most elegant of all the finny tribes. The male is of a bright red colour from the top of the head to the middle of the body; the rest is of a gold colour, but it is so splendid that the finest gilding (according to Father Le Compte) cannot approach it. The female is white, but her tail and half of her body resemble the lustre of silver. Father Du Halde, however, observes, that the red and white colours are not always the distinguishing marks of the male and female; but that the females are known by several white spots which

Brilliant colours—liveliness.

are seen round the orifices, that serve them as organs of hearing, and the males by having these spots much brighter. The nostrils of the gold fish are double, wide, and placed near the eyes. The body is covered with large scales, and the tail is forked; but there is no fish in which the fins vary so much. The colour of the gold fish changes with age. In the first years it is generally black, a colour very rarely found among the inhabitants of the watery element. In the course of a few years more, silver spots make their appearance, and gradually increase till they cover the whole body. It then turns red, and becomes more beautiful the older it grows. Sometimes, indeed, it turns red before it assumes the silvery hue, and in some instances the fish is red from the very first.

These fish are natives of a lake not far from the high mountain of Tsienking, near the city of Tchangou, situated in the province of Che Kiang, in China, in about thirty degrees twenty three minutes of north latitude. From this place they were transported to the other provinces of that empire, to Japan, and at length to Europe. In China and Japan, every person of fashion keeps them for ornament, either in the basins which decorate the courts of their houses, or in porcelain vases. The beauty of their colours, and the liveliness of their motions, afford much entertainment, particularly to the ladies, whose pleasures, by reason of the cruel policy of that

When first introduced into England.

country, are extremely limited, and who take great delight in feeding them. About the year 1691 they were first introduced into England, but were not generally known till 1728. A great number were then brought over and presented to Sir Matthew Dekker, by whom they were distributed in the vicinity of the metropolis, whence they have found their way to most parts of the country. They are now perfectly naturalized, and breed as freely in open waters as the common carp: a large quantity are bred in the gardens of Bagnigge Wells, near Pancras, Middlesex; the water in which they live being a mixture from the chalybeate, and cathartic springs of this place; in all probability these waters are congenial to their nature. They have also been introduced with some success into France, Holland, and several cities of Germany, where they grow very fast. On this subject M. Oelrichs of Bremen, says, "I possess a considerable number of gold fish, the offspring of eight which I received from M. Rouwe. I keep them in a small basin about thirty-six feet long, which I had made on purpose for them, and where they live extremely well. I have not observed that a single one has died. The eight first, which were only about half the length of a man's finger when I received them, have grown so much that two of them are now the size of small herrings. The young ones do not grow very fast, perhaps, be-

Proper food when kept in glasses.

cause the basin is overstocked. The old fish were blackish when I received them; at present two are quite red; another begins to turn red, and is black only on the back; the remainder have not changed their colour. Among the young ones, I have at different times, remarked some that were quite red when they were scarcely of the length of a finger. It is the red fish alone that become silvery, but only when they grow old; the red colour turning pale by degrees, till at length it changes to white. The red spots begin to appear at the end of the tail, and are very striking to the eye, particularly in those fish that are black. I feed them like carp, with white bread."

Gold fish when kept in glasses, or china vases, are fed with cake, bread crumbled very fine, hard yolks of eggs reduced to a powder, hashed pork, and snails, of which they are said to be very fond: they also eagerly devour flies that are thrown to them. Some have imagined that they need no aliment: it is true, indeed, they will subsist for a long time without any apparent food, but what they can collect from pure water frequently changed: yet they must draw some support from animalculæ, and other nourishment supplied by the water; because, though they seem to eat nothing, yet the consequences of eating often drop from them; and that they are best pleased with this jejune diet, may easily be confuted, since if you toss

Manner of their moving.

them crumbs of bread, they will seize them with great readiness, not to say greediness; however, bread should be given sparingly, lest, turning sour, it corrupt the water. They will also feed on the water plant lemna, (duck's meat) and also on small fry. In summer, their water must be changed twice a week, and oftener when the weather is very hot and close. Whilst this is done it is necessary to remove the fish into another vessel, but they must always be taken out by means of a net, for the least handling would destroy them. In winter, it is sufficient to give them fresh water once in a week or fortnight. In ponds whose bottom consists of mud, or clay, they need not be supplied with food; but if the bottom be sandy, they must be fed with bread made of hempseed flour, dung, or wheat bread. These fish are fond of shady places; it is therefore advisable to throw them a branch of some tree as a shelter, observing that it should be of such a kind as not to communicate any bad taste to the water, which would destroy the fish.

When gold fish want to move a little, they gently protrude themselves with their pectoral fins; but it is with their strong muscular tails only that they and all fish shoot along with such inconceivable rapidity. In these vessels, the dying of fish may be observed with accuracy; as soon as the creature sickens, the head sinks lower and lower, and it stands as it were on its head; till

How kept in China—Docility.

getting weaker, and losing all poise, the tail turns over, and at last it floats on the surface of the water with its belly uppermost.

When dead these fish lose all their lustre. It is the general opinion that the eyes of fish are immovable, but these apparently turn them forward or backward in their sockets according to their inclinations. They take little notice of a lighted candle though applied close to their heads, but bounce and seem much frightened by a sudden stroke of the hand against the support whereon their bowl is hung, especially when they have been motionless, or perhaps asleep. As fish have no eyelids, it is not very easy to discern when they are sleeping or not, because their eyes are always open.

In China these fish are kept in ponds, or large porcelain vessels, by almost every person of distinction. In these they are very lively and active, sporting about the surface of the water with great vivacity; but they are so very delicate that, if great guns are fired, or any substances giving out a powerful smell, as pitch or tar, are burned near them, numbers of them will be killed. In each of those ponds or basins where they are kept, there is an earthen pan, with holes in it, turned upside down. Under this they retire when, at any time, they find the rays of the sun too powerful.

When gold fish are kept in ponds, they are often taught to rise to the surface of the water at

the sound of a bell, to be fed, for they are very quick of hearing. The Chinese use a small whistle for calling them together, and it is said that they learn to know the step of the person that feeds them, and make their appearance when they hear him coming at a distance. At Pekin, for three or four months of the winter, or whilst the cold weather lasts, the fish in the ponds are not fed at all. They are able during that time, to get the small quantity of food they require in the water. In order to prevent their being frozen, they are often taken into the houses, and kept in china vessels, till the warm weather of spring allows their being returned to their ponds with safety. When gold fish are fed in China, (which is during the summer months) their food consists of balls of paste, and the yolks of eggs boiled very hard.

In warm countries these fish multiply fast, provided care be taken to collect their spawn, which floats on the water, and which they almost entirely devour. This spawn is put into a particular vessel exposed to the sun, and preserved there until vivified by the heat. Gold fish, however, seldom multiply when they are kept in close vases, because they are then too much confined. In order to render them fruitful, (according to the advice of Le Compte, and other celebrated naturalists who have bred them), they must be put into reservoirs of considerable depth, in some

The spawn collected by the Chinese.

places at least, and which are constantly supplied with fresh water."

"At a certain time of the year," says Grosier, in his description of China, "a prodigious number of barks may be seen in the great river Yang-tse-hiang, which go thither to purchase the spawn of these fish. Towards the month of May, the neighbouring inhabitants shut up the river in several places with mats and hurdles, which occupy an extent of almost nine or ten leagues, and they leave only a space in the middle, sufficient for the passage of barks.

"The spawn of the fish, which the Chinese can distinguish at first sight, although a stranger could perceive no traces of it in the water, is stopped by these hurdles; the water mixed with spawn is then drawn up, and after it has been put into large vessels, it is sold to merchants, who transport it afterwards to every part of the empire. This water is sold by measure, and purchased by those who are desirous of stocking their ponds and reservoirs with fish.

"The fry, when first produced, are perfectly black, but they afterwards change to white, and then to gold colour. The latter colours appear first about the tail, and extend upwards. The smallest fish are preferred for vases, not only from their being more beautiful than the larger ones, but because a greater number of them can be kept. In order to display their movements

Description.

and beautiful colours at a distance, large and wide vases of white glass are principally used. When thus enclosed they seldom exceed six or eight inches in length, but in ponds they grow to twelve or fourteen inches."

THE CARP.

THE mouth of this fish is toothless; their gills have three rays, and their belly fins frequently nine. Their form is somewhat thick, and their colour blue-green above, greenish-yellow mixed with black on the upper part of their sides, whitish beneath, and the tail yellow or violet. The scales are large. On each side of the mouth there is a single beard, and above this another shorter. The dorsal fin is long, extending far towards the tail, which is forked. They are found in the slow rivers and stagnapt waters of Europe and Persia, and here principally in deep holes, under the roots of trees, hollow banks, or great beds of flags, &c. They do not often exceed four feet in length, and twenty pounds in weight; but Jovius mentions some caught in the Lago di Como, in Italy, that weighed two hundred pounds each; and others have been taken in the Dniester five feet in length. Near Angsburg, in Prussia, they are caught weighing forty pounds. At Dortz, in the New Mark, on the

Various sizes in various places.

frontiers of Pomerania, one was caught weighing thirty-eight pounds. In 1711, another was taken at Bishopshausen, near Frankfort on the Oder, measuring two ells and a half in length, and one in breadth ; it weighed seventy pounds, and the scales were as large as a shilling. Mrs. Garrick informed Sir John Hawkins, that she had seen, in her own country (Italy), the head of a carp served up at table, sufficient to fill a large dish. Mr. Ladbroke, from his park at Gatton, presented Lord Egremont with a brace that weighed thirty-five pounds, as specimens, to ascertain whether the Surry could not vie with the Sussex carp. In 1793, at the fishing of the large piece of water at Stourhead, where a thousand brace of killing carp were taken, the largest was thirty inches long, upwards of twenty-two broad, and weighed eighteen pounds. In the river Dniester, they grow to such a size that knife handles are made of their bones.

Carp are supposed to have been brought to this country by Leonard Mascall, a Sussex gentleman, (in which county, perhaps, this fish abounds, more than in any other), about the year 1514, and it is remarked in an old distich, enumerating some good things, of which this island was destitute prior to that period, that

“Turkies, carps, hops, peckerell, and beer,
Came into England all in *one* year.”

This, however, the Rev. Mr. Daniel, in his

Their flavour differs according to their residence.

“Rural Sports,” proves to be erroneous, “for” says this author, “in the *Boke* of St. Albans, printed at Westminster, by Wynken de Worde, in 1496, that carp was mentioned as a *dayntous fishe* although scarce.” From whence they were transplanted cannot be ascertained. Russia wants these fish at this day, and in Sweden they are only in the ponds of persons of distinction. Polish Prussia, is the chief seat of the carp, where they abound in the rivers and lakes, and are taken of a great weight—are an article of commerce—are brought by the merchants from the waters of the noblesse, and are conveyed in well-boats, to the two first mentioned countries.

Carp are found in gentle currents, lakes, and ponds. Their flavour differs according to the waters in which they reside, and causes them to be distinguished by the names of river, lake, and pond carp. The first are accounted the best, and the last the worst; those inhabiting a lake, or pond, through which runs a stream, that furnishes them with a continual supply of fresh water, are far superior to any others. Their colour indicates in what water they have been caught. The carp of rivers, or large lakes, are generally yellow, while those of the ponds are dark green, or inclined to black. The latter commonly have a taste of mud, but this they lose if put into clear water a few weeks, or left for some days in a cage in the current of a river.

Carp, from their quick growth and vast in-

Value—Docility—Longevity.

crease, (for the roe when taken out has frequently been found to weigh more than the fish,) are the most valuable of all fish for the stocking of ponds; and if the breeding and feeding of them were better understood, and more practised, the advantages resulting from them would be very great. A pond stocked with these fish would become as valuable to its possessor as a garden. By being constantly fed they may be rendered so familiar as always to come to the side of the pond where they are kept for food. Dr. Smith, speaking of the Prince of Condé's seat at Chantilly, in his 'Tour to the Continent,' says, "The most pleasing things about it were the immense shoals of very large carp, silvered over with age, like silver fish, and perfectly tame, so that, when any passengers approached their watery habitation, they used to come to the shore in such numbers as to heave each other out of the water, begging for bread, of which a quantity was always kept at hand on purpose to feed them; they would even allow themselves to be handled." Sir John Hawkins was assured by a clergyman, a friend of his, that at the abbey of St. Bernard, near Antwerp, he saw a carp come to the edge of its pond at the whistling of the person who fed it. Other wonderful stories are told of the docility of this fish.

Carp are remarkable for their longevity. Lel del says, that in the ponds of Lusatia, there are carp two hundred years old. Buffon declares,

Time of spawning—Fecundity.

that he himself saw carp in the fosses of Pont-Chartrain, that were known to be upwards of one hundred and fifty years of age. In the King of Prussia's garden at Charlottenburg, there are carp remarkably old, of which we shall make hereafter mention. Gessner relates an instance of one that was a hundred years old, and the pond in the garden of Emanuel College Cambridge, contained a carp that had been an inhabitant more than seventy years. Like other fish of this genus, carp live upon plants, mud worms, and aquatic insects.

Carp spawn in June, and sometimes in May, when it is a forward spring, seeking places covered with grass or plants, for depositing its eggs. One female is usually accompanied by three males. At this season the river carp proceed in shoals towards the still waters which communicate with the river, and if their course be stopped by a dam or weir, they leap over it, when it does not exceed the height of four to six feet. After they have spawned, they return to the rivers. Though exposed to the voracity of several kinds of fish, and aquatic birds, they multiply very fast; in a carp weighing only nine pounds and three quarters, Dr. Bloch found two hundred and thirty-five thousand eggs. Soon after, he says M. von Schlegel sent him one of the carp with which he used to stock his ponds, informing him at the same time that he was at a loss how to get rid of the young fry, which were

Two bastard species—Forster's remarks.

so numerous as to deprive each other of the necessary food. A few fish only produced a hundred thousand young carp. The last mentioned carp weighed nineteen pounds; and its eggs one pound fourteen ounces. A drachm of these eggs contained one thousand two hundred and ninety-five, so that the whole roe could not consist of less than six hundred and twenty-five thousand and six hundred. The carp in M. Schlegel's ponds grow to a great size, which Bloch attributes to the abundance of the plant called Naya, which grows in them.

A mixed breed is produced by the carp with the gible and crusian, two varieties of the carp genus, which never attain the size of the carp, but are considerably larger than the two latter fish. These bastard species seldom weigh more than three pounds, and always have the head and tail of the male parent. It is supposed they are incapable of continuing the breed.

Mr. J. Rheinhold Forster, in the Philosophical Transactions for 1771, says, in Polish Prussia, and many other parts of Germany, where the sale of the carp constitutes a part of the revenue of the nobility and gentry, the proper management of that fish is reduced to a kind of system, founded on the experience of several generations. The author here communicates all the particulars which he has been able to collect from the practice of these experienced breeders and feeders of carp, and from his own observation. He recollects to

Capable of living out of water.

have seen some of these fish, thus treated and maintained, above a yard long, and of twenty five pounds weight: but had no opportunity of ascertaining their age. "In the pond, however, at Charlottenburg," he adds, "a palace belonging to the king of Prussia, I saw more than two or three hundred carp, between two and three feet long; and I was told by the keeper they were between fifty and sixty years standing. They were tame, and came to the shore in order to be fed; they swallowed with ease a piece of white bread of the size of half a halfpenny roll."

This fish is extremely tenacious of life, as it is capable of not only living for a considerable time out of water, but of its growing fat in its new element. Mr. J. R. Forster has seen the experiment successfully tried, and attended to the whole process, in a nobleman's house where he then resided, in the principality of Anhalt Dessau. "The fish," he says, "being taken out of the water, is wrapped up in a large quantity of wet moss, spread on a piece of net, which is then gathered into a purse; in such a manner, however, as to allow him room to breathe. The net is then plunged into water, and hung up to the ceiling of a cellar. At first the dipping must be repeated every three or four hours; but afterwards the carp need only be plunged into the water once in about six or seven hours. Bread soaked in milk is first given him in small quantities. In a short time the fish will bear more and grow fat

Cunningness of the carp.

under this seemingly unnatural treatment.”— This strange account is partly confirmed by Mr. Daines Barrington, in a note, who mentions the practice of a certain fishmonger near Clare-market, who, in the winter, frequently exposes a bushel at least of carp and tench for sale, in the same dry vessel, for six or seven hours; many of which are not sold, and yet continue in health, though breathing nothing but air during the time above-mentioned, for several successive days.

From the spawn of this fish, caviare is made for the Jews, who hold the sturgeon in abhorrence. The carp is extremely cunning, and on that account is sometimes styled the *river-fox*. When attempted to be taken by nets, they will sometimes leap over them, and escape that way; at other times they will immerse themselves so deep in the mud as to let the net pass over them. They are also very shy in taking a bait; yet at the spawning time they are so simple as to suffer themselves to be tickled, handled, and caught by any body who will attempt it.

Having observed that the carp is the most valuable of all fish for stocking of ponds; we shall now give some directions for so doing.--- The females do not begin to breed till eight or nine years old; so that in breeding-ponds a supply must be kept of carp of that age. The best judges allow, that in stocking a breeding-pond, four males should be allowed to

twelve females. The usual growth of a carp is to two or three inches in length in a year; but in ponds which receive the fattening of common sewers, they have been known to grow from five inches to eighteen in one year. A feeding-pond of one acre extent will very well feed three hundred carp of three years old, three hundred of two years, and four hundred of one year old. Carp delight chiefly in ponds that have marley sides; they love also clay-ponds well sheltered from the winds, and grown with weeds and long grass at the edges, which they feed upon in the hot months. Carp and tench thrive very fast in ponds and rivers near the sea, where the water is a little brackish; but they are not so well tasted as those which live in fresh water. Grains, blood, chicken-guts, and the like, may at times be thrown into carp-ponds, to help to fatten the fish. To make them grow large and fat, the growth of grass under the water should by all possible means be encouraged. For this purpose, as the water decreases in the summer, the sides of the pond left naked and dry, should be well raked with an iron rake to destroy all the weeds, and cut up the surface of the earth: hay-seed should then be sown plentifully in these places; and more ground prepared in the same manner, as the water falls more and more away. By this means there will be a fine and plentiful growth of young grass along the sides of the pond to the water's edge; and when the rains

Mr. Tull's method of fattening carp.

fill up the pond again, this will be all buried under water, and will make a feeding place for the fish, where they will come early in the morning, and will fatten greatly upon what they find there.

Mr. Tull, famous for his improvements in husbandry, communicated to Sir Hans Sloane the method of fattening carps by castration. The castrated carp being put into water with six live ones, seemed only a little less brisk in swimming. The castrated carp is said to excel the others in delicacy of flavor as much as a capon does a cock, or a fat ox exceeds a bull.

Of the sound or air-bladder, a kind of fish-glue is made, and a green paint of their gall.

The carp is held in great esteem by most of the eastern nations. The great Mogul, before he goes to war, or undertakes any affair of importance, prays with his hands resting on a large carp.

In a domesticated state these fish require some attention, particularly in winter, when care must be taken that they be not stifled for want of air beneath the ice. When a pond is frozen, some of the water should be let off, so as to leave a vacancy between it and the ice; but when the frost is not very intense, holes made in the ice will be found sufficient. These holes, however, should not be made too near the basin, lest the carp be disturbed, when they may leap upon the ice, and perish with cold. When a pond

begins to be frozen, the carp seek the deepest part; they there make holes in the form of a basin, in which they bury themselves, crowding as close to each other as herrings in a cask; and thus they pass the winter without motion or food. It has been found that a carp weighing three pounds and a half, does not lose above a quarter of a pound during this long fast.

If lightning strike upon a pond or lake, it has been observed that the fish die in the course of a few days; but this may be prevented by immediately letting off the water, and introducing fresh: very few of the fish perish when this precaution is taken.

Carp are subject to two diseases, called the small-pox, and the moss. The former consists of pustules which appear between the skin and the scales, and is seldom mortal. The latter shews itself in small excrescences resembling moss, which are perceptible on the head and down the back. Of this disease, caused by corrupted waters brought by violent rains, the carp frequently die. The only remedy for it is to renew the water of the pond. The carp likewise fall sick, if a great quantity of snow-water run into the pond in consequence of a sudden thaw. But if they have a sufficiency of fresh water in summer, if the season be not too hot, and if in winter, care be taken to prevent their being stifled under the ice, the proprietor need be under no ap-

The frog an enemy to the carp.

prehension either of disease, or any other inconvenience.

The frog is a mortal enemy to the carp, more so by destroying its spawn, than by fastening himself on its head, a circumstance which has, however, been strongly asserted as a fact, and that the carp pines away in consequence of the close adhesion of the frog, which cannot be separated from the head of the fish without extreme force, or killing.

“The angler’s patience,” says the author of *Rural Sports*, “will be peculiarly called forth, in attempting to beguile the large carp, although small ones will generally bite eagerly: the rod and line should both be long, and of the strongest materials. A quill float, a hook of size corresponding to the bait, and whipt to good silk-worm-gut, on which one shot should be placed, twelve inches from it. Three rods may be employed; one with the bait at mid-water, another a foot or less from the bottom, and the third to lie upon it, when the line and lead are not discovered, as in the two former; the places intended to be fished in should, the night before, be ground-baited with grains, blood, and broken worms, incorporated together with clay; the hook-baits should be red worms, taken out of tan, flag or marsh worms, green peas so boiled as to soften but not to break the skin, and throwing some in now and then; when this bait is

Description.

used (which should be with one on the hook to swim a foot from the ground), in case of a bite, strike immediately. A large carp upon taking the bait, directly steers for the opposite side of the pond or river.

THE BARBEL.

THIS fish, which is a native of all the southern countries of Europe, is distinguished from the other species of carp, by the projection of the upper jaw beyond the lower, and by the barbs or wattles at the mouth, from which it derives its name in almost every language. In form it very much resembles the pike. The head is oblong, and terminates in a point. The upper lip is strong, and the fish can project or contract it at pleasure. The four beards are attached to the upper jaw; the two situated near the end of it are shorter than the others. The scales are of a pale gold colour, edged with black; they adhere very firmly to the skin, and according to Richter they exceed five thousand in number. The colour of the back is a pale olive, the belly is silvery, and proceeds without protuberance nearly in a straight line, so that when it reaches the bottom, the mouth at the same time touches the ground. The back is a little arched, from the middle of it rises one dorsal fin with ten rays, of which the first is

Food—Different sizes.

the largest. The tail is forked, and between it and the anus rises another fin, supported by seven rays.

The barbel lives upon snails, worms, and small fish. Dr. Bloch says that he found a young perch in the mouth of a large barbel. It is likewise fond of human flesh, for in 1683, after the siege of Vienna, when the bodies of the Turks and animals were thrown promiscuously into the Danube, the barbels were seen to flock in great numbers around the human carcases, and were most of them taken. With such a variety of food it is not surprising that the barbel's growth should be very quick. In the Oder, barbels are caught three feet in length, and weighing six or eight pounds. Those in the Weser weigh from twelve to fifteen; and Pennant says, that they are sometimes found of the weight of eighteen pounds. In the Weser, the flax which is soaked in the river makes them so fat, that they are not at all inferior in flavour to salmon. As they follow the flax, the fishermen take advantage of this circumstance to catch great quantities of them. In the river Aik, the barbel fishery is one of the principal occupations of the Cossacks during winter. The barbel is found in most of the other Russian rivers and lakes, and, here it is sometimes caught of thirty pounds weight. In summer a barbel of that size costs but five or eight copecs; but in winter it will fetch from thirty to forty. At Astracan and Terek, the

Season of spawning—False assertion.

tongue of the barbel is pickled, afterwards put into barrels, and sent to Petersburg. The Cossacks who inhabit the country adjacent to the river Uralck, make isinglass with the sound or air-bladder of the barbel, but it is much inferior in quality to that obtained from the sturgeon. The barbel does not breed till it is four or five years old. The season of spawning is in May, and in June, if it be a backward spring. It then ascends the rivers, depositing its eggs underneath the stones, in places where the current is most rapid. While it is young, the barbel is in danger from all the voracious fish, particularly the loche. In a fish weighing three pounds and a half, caught in the month of April, that is, a short time previous to the season for spawning, Dr. Bloch found a roe not exceeding three quarters of an ounce in weight, containing eight thousand and twenty-five eggs of the size and colour of grains of millet.

Some writers assert that the eggs of this fish are of a poisonous quality, and occasion fatal accidents to those who eat them; but experience proves that this opinion is fallacious. Dr. Bloch states that he himself, and all his family, ate of the eggs of the barbel without sustaining the smallest inconvenience in consequence.

Klein speaks of a king of the barbels, as of a particular species, distinguished from the others by the great length of his fins. But as he confesses, that he never saw but one of the kind

Seldom eaten but by the poorer sort.

and that in a collection at Dresden, and as other writers make no mention of this fish, the length of its fins was probably the effect of accident, or a trick of some vender of natural curiosities.

The barbel is so extremely coarse as to have been overlooked by the ancients; yet Pliny, in mentioning one reported by Mutianus to have been caught in the Red Sea, that weighed four score pounds, exclaims, "Oh! what a price he would have borne among our gluttons here with us." These fish are the worst and coarsest of fresh water fish, and are seldom eaten but by the poorer sort of people, who sometimes boil them with a bit of bacon to give them a relish. Their roe is very noxious, and consequently may affect some who eat it with vomiting, &c.

They frequent the still and deep parts of rivers, and live in society, rooting like swine with their noses in the soft banks. The barbel is so tame as to suffer itself to be taken by the hand; and people have been known to take numbers by diving for them. In summer they move about during night in search of food; but toward autumn, and during winter, some insist that they confine themselves to the deepest holes; but this is erroneous, as the fishermen would take them with nets at that season as well as other fish, if they were then in the water; but they are always found in rivers near the sea.

If there be any difference in the taste of the flesh they are most in season the latter end of

summer, but, in fact, they are not worth notice, except from the sport the angler derives from the catching of them, and which, from their being so strong and determined when hooked, is very great.

Their biting months commence in May, and continue until September; the time from sunrise to ten in the morning, and from four in the afternoon to sun-set. The rod must be very strong; and the baits are to be lob worms well scowered, and new cheese cut in small squares, for barbel though free, are nice feeders.

Three of the largest barbel ever caught at Hampton, by angling, were taken in 1793, by a gentleman of Burlington-street, and which weighed thirty-nine pounds.

THE TENCH.

THIS, according to Artedi, is a species of the carp, and is thick and bulky in proportion to its length. The colour of the back is dasky; the dorsal and ventral fins of the same colour; the head, sides, and belly, of a greenish cast, most beautifully mixed with gold, which is in its greatest splendor when the fish is in highest season. They love still waters, and are rarely found in rivers; they are very foolish, and easily caught.

This is one of those fish that prefer foul and

Esteemed by some and despised by others.

weedy waters ; and its haunts in rivers are chiefly among weeds, and in places well shaded with rushes. These fish thrive best in standing waters, where they lie under weeds near sluices and pond heads. They are much more numerous in pools and pits than in rivers ; but those taken in the latter are far preferable for the table. They begin to spawn in June, and may be found spawning in some waters till September. The best season is from that time till the end of May.

These fish do not often exceed four or five pounds in weight. Mr. Pennant, however, mentions one that weighed ten pounds. Tench are in great repute with us as a delicious and wholesome food ; but in Guernsey they are considered bad fish, and in contempt called *Schoemaker*. Gessner even says, that it is insipid and unwholesome. Like the barbel, it was unnoticed by early writers, and Ausonius, by whom it was first mentioned, treats it with that disrespect which evinces the capriciousness of taste.

The slime of the tench is supposed to possess such healing properties among the fish that, it is said, the pike, on this account, never attempts to seize it, though he devour, without exception, all the other species that he is able to overcome : thus Mr. Diaper in his piscatory eclogues, poetically says,

“ The pike, fell tyrant of the liquid plain,
With ravenous waste devours his fellow train :
Yet, howso'er with raging famine pin'd,
The tench he spares, a medicinal kind ;

Supposed properties of its slime.

For when by wounds distrest, or sore disease,
He courts the salutary fish for ease;
Close to his scales the kind physician glides,
And sweats a healing balsam from his sides."

This incident has been the origin of many curious stories: however, this self-denial of the pike may be attributed to a more natural cause; the tench are so fond of mud as to be constantly at the bottom of the water, where probably they are secure from the voracious attacks of their neighbour.

These fish are sometimes found in waters where the mud is excessively fetid, and the weeds so thick that a hand-net can scarcely be thrust down. In these situations they grow to a large size, and their exterior becomes completely tinged by the mud. Their flavour from this, if cooked immediately on being taken out, is often very unpleasant; but, if they are transferred into clear water, they soon recover from the obnoxious taint.

A Tench was taken at Thornville Royal, in Yorkshire, in 1802, of such an enormous size, and so singular in its shape, as to be accounted rather a *lusus naturæ* than a regular product. A piece of water which had been ordered to be filled up, and into which wood and rubbish had been thrown for some years, was directed to be cleared out. So little water remained, and in such quantity were the weeds and mud, that it was expected no fish would be found except

Singular tench taken at Thornville Royal.

perhaps a few eels ; but, greatly to the surprise of the persons employed, nearly two hundred brace of tench, and as many of perch were discovered. After the pond was supposed to be quite cleared, an animal was observed to be under some roots, which was conjectured to be an otter. The place was surrounded, and on making an opening, a tench was found of most singular form, having literally taken the shape of the hole in which he had of course been many years confined. His length was two feet nine inches, his circumference two feet three inches, and his weight near twelve pounds. The colour was also singular, his belly being tinged with vermilion; like that of a char. This extraordinary fish, after having been examined by many gentlemen, was carefully put into a pond. At first it merely floated, and after a while it swam gently away. When Mr. Daniel produced his "Rural Sports" it was alive and well.

Notwithstanding this account was authenticated by persons of veracity, the following witticisms of incredulity, in prose and verse, appeared in the public prints.

"The *yellow-bellied* TENCH of Thornville House, in Yorkshire, which is *supposed* to have lain so many *centuries*, and lived under the *roots* of some ancient *trees*, without water, is to be dressed at that celebrated mansion, as soon as an instrument is procured in which a proper *kettle of fish* may be made of this amphibious animal : it

is to be served up with *sauce piquent*, at a kind of *Arthur's Round Table*, to a select corps of Knights of the long bow."

" THE TENCH OF THORNVILLE ROYAL,

"A TRUE STORY !!!

" O' the marvelous,
At Thornville house,
We read of feats in plenty,
Where with long bow
They hit, I trow,
Full nineteen shot in twenty.

" Their fame to fix,
'Midst other tricks,
In which they so delight, Sir,
These blades, pray know,
The hatchet throw
Till it is out of sight, Sir."

" Of beast and bird
Enough we've heard,
By cracks as loud as thunder,
So now they dish,
A monster fish,
For those who bite at wonders.

" The scullion wench
Did catch a tench,
Fatter than Berkshire hogs, Sir,
Which, pretty soul,
Had made a hole,
Snug shelter'd by some logs, Sir !

" Sans water he
Had liv'd d'ye see,
Beneath those roots of wood, Sir !
And there, alack,
Flat on his back,
Had lain since Noah's flood, Sir !

Simple, and caught without difficulty.

“ Now he's in stew
For public *goût*,
And fed with lettuce-coss, Sir,
In hopes the town
Will gulp him down,
With good humbugging sauce, Sir !”

These fish are very simple, and are usually caught with a line without difficulty. The baits generally adopted are the small red worms taken out of rotten tan, wasp maggots, or marsh worms. The season for angling is from September to June. The fish will bite during the greater part of the day, but the expert angler generally attends as early and late as possible.

THE CHUB.

THIS fish, which is also called chevin nob, or botling, very much resembles the carp, but is of a longer form, the body is oblong, rather round, and is of a pretty equal thickness in the greater part of the slope ; the scales are large ; the irides silvery ; the cheeks of the same colour ; the head and back of a deep dusky green ; the sides silvery, but in the summer yellow ; the belly white ; the pectoral fins of a pale yellow ; the ventral and anal fins red, and the tail forked, of a brownish hue, but tinged with blue at the end. It is altogether a handsome fish ; but not in esteem for the table, being very coarse, and when

Chief haunts—General weight.

out of season, full of small hairy bones ; the roe however, is very good, and this fish, stewed as carp will, it is said, deceive a connoisseur. Its name is derived from the shape of the head, *cop* being an old English word for head, and the French and Italians know it by a name synonymous with ours.

The haunts of these fish are rivers whose bottoms are of sand or clay, or which are bounded by clayey banks ; in deep holes, under hollow banks, shaded by trees or weeds. They are also found in the Esk, a river noted for the chrystalline clearness of its waters, flowing over a rocky bottom. These fish often float on the surface, and are sometimes found in deep waters, where the currents are strong. In ponds fed by a rivulet they grow to a great size. They seldom, however, exceed the weight of four or five pounds : though Salvianus speaks of them as encreasing to eight or nine.

They deposit their spawn in April ; and are in greatest perfection during the months of December and January.

The chub does not afford the angler so much diversion as the trout ; when he seizes a bait, he bites so eagerly, that his jaws are often heard to chop like those of a dog. He, however, seldom breaks his hold, and when once he is struck, is soon tired. The time of angling for chub is from August to March, but best in the winter months. In mild cloudy weather the chub will bite all day ;

Description—Liveliness—General weight.

in hot weather from sunrise till nine o'clock; and from three in the afternoon till sunset. In cold weather the best time is the middle of the day. The baits are various kinds of worms, grasshoppers, blue-bottles, beetles, and almost any natural or artificial fly.

DACE, OR DARE.

THE head of dace is small, the irides of a pale yellow; the body long and slender; the back varied with dusky, and a cast of yellowish green; the sides and body silvery; the ventral, anal, and caudal fins are sometimes of a pale red hue, and the tale is very much forked. These fish are gregarious and very lively; during summer they are fond of playing near the surface of the water. They are generally found where the water is deep, and the stream gentle, near the piles of bridges. They also frequent deep holes that are shaded by the leaves of the water-lily; and under the foam on the shallows of streams.

Dace seldom weigh more than a pound and a half, being seldom above ten inches long: although in a list of fish sold in the London markets, with the highest weight of each, communicated to Mr. Pennant, there is an account of one that weighed a pound and a half; and according to Linnæus, it grows to a foot and a half in length.

Fecundity—Time for angling.

Dace are exceedingly prolific. They spawn in March, and are in season three weeks afterwards. They improve, and are good about Michaelmas, but are best in February. In this month, if, when just taken out of the water, they are scotched and broiled, they are said to be even more palatable than a herring. Their flesh, however, is generally insipid, and full of bones.

These fish afford great amusement to the angler. The baits are various kinds of worms, and the common flesh-flies. The season for angling is from April to February, but best in the winter. In hot weather, the time is early and late in the day: in cold weather, during the middle; and in mild cloudy weather, the whole of the day.

In the Mersey, near Warrington, a fish called the graining is taken, which very much resembles the dace, but is slenderer, and the back shorter, the usual length not exceeding eight inches. The colour of the back is silvery, with a bluish cast; the eyes, ventral and anal fins are paler than those of the dace, but the pectoral fin is redder, and they are much better eating.

THE ROACH.

THIS, which is a handsome fish either in or fresh out of water, has large eyes, the circle of which resembles gold colour, and the iris red. It

Simplicity—When in season.

is deep but thin, and the back elevated; the side-line bends much on the middle towards the belly, and the tail is a little forked.

This fish is found chiefly in deep still rivers, where it is often seen in large shoals. In summer, it frequents shallows near the tails of fords; or lies under banks among weeds, and shaded by trees or herbage, especially where the water is thick. As the winter approaches, these haunts are changed for deep and still waters.

The roach is so silly a fish that it has acquired the name of the water-sheep, in contradistinction to the carp, which from its subtilty is termed the water-fox. "Sound as a roach," is a proverb that appears but indifferently founded. It is, however, used by the French as well as by us.

The flesh of this fish, though reckoned very wholesome, is in little esteem, from the great quantity of bones. The roe, which is green and boils red, is remarkably good. Roach are in season from Michaelmas to March, their scales are then very smooth; but when they are out of season, these feel like the rough side of an oyster-shell. Their fins are generally red, when the animals are in perfection. They spawn towards the latter end of May, producing, it is said, above 54,000 ova, and for three weeks after are unwholesome. They begin to recover in July, but it is Michaelmas before they are eatable. They are said to be best in February or March. These

fish differ greatly in goodness, according to the rivers in which they are caught. None are good that are kept in ponds.

Roach feed on aquatic plants and vermes. Their usual weight is from half a pound to two pounds. Some, however, have been known to weigh as much as five pounds.

The baits used in catching roach are various kinds of worms, flies, and pastes; a roach will generally attend the fly to the surface, there gaze on it for a moment, and then take it. The time for angling is, in mild cloudy weather, all the day: in hot weather only in the mornings and evenings; and in cold weather, during the middle of the day.

THE BREAM.

THIS well-known fish is broad, with a small head, smooth at the top, large eyes, a small leather mouth, no teeth, but a lozenge-like bone to help its grinding; the palate is soft and fleshy, resembling that of the carp; it is covered with curious net-work scales, on which it has sometimes abundance of minute whitish tubercles; it has a hog-back, of a colour between blue and black; the sides of the largest are yellowish, and the belly inclining to red; is extremely deep and thin in proportion to its length; the tail is very

Where found—Time of spawning.

large, and something in the form of a crescent. The flesh is soft and clammy, yet by some reckoned of easy digestion, and more nourishing than carp; the choice parts are the belly and head, and the best way of preparing it for table is by pickling it like salmon. Though neglected by the English, this fish is highly esteemed by the French.

Bream are found in slow-running deep rivers, but chiefly in extensive ponds, where, although they grow tardily, they will attain the weight of three or four pounds (they have been known to weigh eight), and if the water and air suit them, they will get very fat: they are great breeders, for it is observed the melter has two melts, and the spawner two large bags of spawn, from which are deposited upwards of 130,000 ova: consequently they are only fit to be put into ponds as food for pike, perch, &c.

Bream spawn about the latter end of June; some prefer them in May, others in September, having then had their summer food; but the general opinion is that they are most in season when big with roe. It is affirmed that bream and roach will breed together, but this is positively contradicted by the Rev. Mr. Daniel.

This fish affords great diversion to the angler. The baits used are the red paste; also paste made of brown bread and honey, gentles, wasp-grubs, flag-worms, and they are great lovers of

In great agonies at certain seasons.

red worms, green flies, and grasshoppers with their legs cut off, in June and July.

Bream swim together in shoals, and may be caught in a gentle stream, the water being rather thick, and a good gale of wind. In ponds, the higher the wind and the rougher the waves, the better. Of rivers, the Mole in Surry, about Dorkingbridge, and upwards, is noted for large bream, as also the Medway in Kent; and they prefer the deepest and widest places. It is rather surprising that this fish is not mentioned in some of our natural histories.

THE BLEAK,

BY some termed the fresh-water sprat, and by others the water-swallow, on account of its nimbleness in catching flies, is from two to five or six inches in length; the head is small, and the skull transparent; the eyes large, with a blood-coloured spot on the lower side; the irides of a pale yellow; the under jaw the longest, the gills silvery; the body is slender, and greatly compressed sideways, not unlike that of the sprat; the sides and belly silvery; the fins pellucid, the lateral line rather crooked; the scales are large, and fall off very easily; the tail is forked.

At certain seasons the bleak seems to be in great agonies; they tumble about near the surface of the water, and are incapable of swimming

Small fish called white-back.

far from the place ; but in about two hours they recover and disappear. Fish thus affected, the Thames fishermen call mad bleaks. They seem also to be so troubled with a species of the gordias, or hair worm, that they rise to the surface and die. They are exceedingly restless, their haunts being sometime in deep still water, and at other times in the streams : they are very common in many of our rivers, and assemble in shoals. They are supposed to be always in season except when spawning, which is said to be in May, from which they recover in about three weeks, and are in highest perfection in autumn. Artificial pearls have been made from the scales of this fish, and likewise of the dace.

During the month of July, (say Goldsmith and Pennant) there appear in the Thames, near Blackwall and Greenwich, innumerable multitudes of small fish, known to the Londoners by the name of white-bait. They are esteemed very delicious when fried with fine flour, and occasion, during the season, a vast resort of the lower orders of epicures to the taverns at the places they are taken. There are various suppositions concerning these fish, all of which terminate in reckoning them the fry of some other fish. Mr. Pennant thinks they are of the carp genus, though he cannot determine the species to which they belong. They certainly have a greater similarity to the bleak than to any other species ; yet he thinks they cannot be the young

Two species, the gobio and scorpio.

fry of that, because the bleak is found in many of the British streams, but the white-bait is only in the Thames.

THE GUDGEON.

THE body of this fish is round; the head broader than the body, with two little holes between the eyes, one before the other; the gill-membrane with six spines:

The principal species of the gudgeon is called the gobio, or river bull-head, which is very common in all our clear brooks; it lies almost always at the bottom, or under a stone: it deposits its spawn in a hole which it forms among the gravel, and quits it with great reluctance. It feeds on water insects. Redi says that this fish has no air-bladder. It seldom exceeds the length of three inches and a half. The head is large, broad, flat, and thin at its circumference, being well adapted for insinuating itself under stones: on the middle part of the covers of the gills is a small crooked spine, turning inwards. The eyes are very small; the irides yellow; the body grows slender towards the tail, and is very smooth. The colour of this fish is as disagreeable as its form, being dusky, mixed with a dirty yellow; the belly whitish. The taste, however, is excellent.

There is another species called the scorpio, or father-lasher, which is not uncommon on the

Time to angle for the gudgeons.

rocky coasts of this island ; it lurks under stones, and will take a bait.—It seldom exceeds eight or nine inches in length. The head is large, and has a most formidable appearance, being armed with vast spines, which it can oppose to any enemy that attacks it, by swelling out its cheeks and gill-covers to a large size. The nose, and space contiguous to the eyes, are furnished with short sharp spines ; the covers of the gills are terminated by exceeding long ones, which are strong, and very sharp pointed. The mouth is large ; the jaws covered with very small teeth ; the roof of the mouth is furnished with a triangular spot of very minute teeth.

This latter species is very frequent in the Newfoundland seas, where it is called scolping ; it is also as common on the coast of Greenland, in deep water near the shore. It is a principal food of the natives, and the soup made of it is said to be agreeable as well as wholesome. Besides these there are four other species.

Gudgeons bite freely, from the latter end of spring until autumn ; the time commences in gloomy warm days, from an hour after sun rise, to within the same time of its setting : during the rest of the year, the middle of the day when it is warmest. The baits are small red worms, gentles, and blood worms.

THE CORYPHÆNA.

OF this fish there are twelve species, most of which are natives of foreign seas. The general characters are, the head is declined and truncated; the membrane covering the gills has six rays, and the back fin runs the whole length of the back. The most remarkable are the blue and parrot fish. The former is described by Catesby as having its head of a very odd structure, resembling that of the spermaceti whale; the mouth is small, each mandible armed with a single row of even teeth, so closely joined, that they seem entire bones; the iris of the eye is red. On the back is a long pliant fin, somewhat indented on the edge; behind the gills are two fins, one under the abdomen, and another behind the anus. The tail is forked, and the whole fish entirely blue. They are taken on the coasts of the Bahama islands, and in most of the seas between the tropics.

The parrot fish has a large mouth, paved as it were with blunt teeth, closely connected, after the manner of the sea-wolf. The body is covered with green scales; the eyes are red and yellow; the upper part of the head brown, the lower part and the gills blue, bordered with a dusky red; a streak of red extends from the throat behind the gills, at the upper end of which is a bright yellow spot. The fins are five in number, one extending almost the length of the back, of a bay or cinnamon colour; there are

More esteemed for beauty than for taste.

two behind the gills blended with black, green and purplish colours, with the upper edge verged with blue; under the anus extends another long narrow green fin with a tint of red through the middle of it; at the basis of the tail, on each side is a long narrow spot. The tail is long, forked and green, with a curved red line running through the middle, parallel to the curve, and ending in two points.

This fish is more esteemed for beauty than for the delicacy of its taste. They are taken on the coasts of Hispaniola, Cuba, and the Bahama Islands.

CHAP. VII.

The springing *trout* in speckled pride,
The *salmon*—monarch of the tide,
The ruthless *pike* intent on war,
The silver *eel* and mottled *par*.

SMOLLET.

THE SALMON.

THE salmon, which was known to the Romans, but not to the Greeks, is a soft-finned abdominal fish. They are distinguished from other fish by having two dorsal fins, of which the hindermost is fleshy and without rays; they have teeth both in the jaws and in the tongue, and the body is covered with round and minutely striated scales. The colour of the back and sides is grey, sometimes spotted with black and sometimes plain; the covers of the gills are subject to the same variety, and the belly is silvery. The nose is sharp pointed, and in the males the under jaw sometimes turn up in the form of a hook.

Rapid and stony rivers, where the water is free from mud, are the favorite places of most of the

Extraordinary leaps.

salmon tribe, the whole of which is supposed to afford wholesome food for mankind.

This fish seems confined in a great measure to the northern seas, being unknown in the Mediterranean, and in the waters of other warm climates. It lives in fresh as well as in salt waters, forcing itself in autumn up the rivers, sometimes for hundreds of miles, for the purpose of depositing its spawn. It abandons the seas where it finds an abundant sustenance, ascends the rivers depopulated by man, endeavors by every kind of artifice to escape the snares of the fisherman, and all this solely for the purpose of finding a convenient place for depositing its eggs. In these peregrinations it is that salmon are caught in the great numbers that supply our markets and tables. Intent only on the object of their journey, they spring up cataracts and over other obstacles of a very great height. This extraordinary power seems to be owing to a sudden jerk that the fish gives to its body from a bent into a straight position. When they are unexpectedly obstructed in their progress, it is said they swim a few paces back, survey the object for some minutes motionless, retreat, and return again to the charge; then, collecting all their force, with one astonishing spring over-leap every obstacle. Where the water is low, or sand-banks intervene, they throw themselves on one side, and in that position soon work themselves over into the deep water beyond. On the river Liffey in

Whimsical experiment.

Ireland there is a cataract about nineteen feet high : here, in the salmon season, many of the inhabitants amuse themselves in observing the fish leap up the torrent. They frequently fall back many times before they surmount it, and baskets made of twigs are placed near the edge of the stream to catch them in their fall.

At the falls of Kilmorack in Scotland, where the salmon are very numerous, it is a common practice with the country people to lay branches of trees on the edges of the rocks, and by this means they often take such of the fish as miss their leap, which the foaming of the torrent not unfrequently causes them to do. And the late Lord Lovat, who often visited these falls, taking the hint from this circumstance, formed a determination to try a whimsical experiment on the same principle. Alongside one of the falls he ordered a kettle full of water to be placed over a fire, and many minutes had not elapsed before a large salmon made a false leap, and fell into it.

As soon as these fish have arrived at a proper place for spawning in, the male and female unite in forming in the sand or gravel a proper receptacle for their ova, about eighteen inches deep, which they are also supposed afterwards to cover up. In this hole the ova lie till the ensuing spring, (if not displaced by the floods,) before they are hatched. The parents, however, immediately after their spawning, hasten to the salt water, now extremely emaciated. Toward the

Season of spawning—Wonderful sensibility.

end of March the young fry begin to appear; and gradually increasing in size, become, in the beginning of May, five or six inches in length, when they are called salmon-smelts. They now swarm in the rivers in myriads; but the first flood sweeps them down into the sea, scarcely leaving any behind. About the middle of June the largest of these begin to return into the rivers; they are now become of the length of twelve or sixteen inches. Toward the end of July they are called gilse, and weigh from six to nine pounds each.

The season of spawning, which lasts but six or eight days, takes place in the month of May, in the southern countries as well as in Great Britain. In the north, in Sweden for instance, it does not happen till July. It is worthy of remark, that the salmon can again find the spot where it has once spawned, in the same manner as the swallow knows the house where she has built her nest. This circumstance is proved by an experiment made by De Lalande, who purchased twelve salmon of the fishermen of Chateaulin, (a small town of Lower Brittany, where sometimes four thousand are caught in a season) fastened a copper ring round the tail of each, and set them at liberty again. The fishermen afterwards informed him that the first year they took five of the fish thus marked, three the second year, and the same number the third. The princes of the East, who are generally fond of

Troubled with insects called salmon-lice.

fishing, frequently fasten rings of gold or silver round salmon, and again throw them into the water. It was by means of these fish that the communication of the Caspian Sea with the Northern Ocean, and Persian Gulf is said to have been discovered.

As soon as the ice begins to melt on the coasts, the salmon seeks the fresh waters, and is consequently found towards spring in the greatest numbers in such rivers whose mouths are narrow, because their waters run out farthest into the sea. In the warm countries of Europe, it arrives as early as the months of February and March; in the northern regions not before April or May. The salmon prefers those waters which have a bottom of sand, or pebbles, and a rapid current; it remains there till towards autumn, and leaving its progeny behind, returns to the sea. Sometimes, however, it passes the winter in the fresh waters, in Sweden particularly, where the rivers are frozen early, and the ice prevents its return. The fishermen have observed, that the salmon fishery is likely to be very productive when they have abundance of insects adhering to the gills, called salmon-lice; experience having shewn that the salmon then enter the rapid rivers in the greatest numbers, in order to get rid of these troublesome companions. Very soon after the salmon have left the sea, these insects die and drop off.

The salmon when entering the rivers, as Dr.

Mode of taking their long voyages.

Bloch remarks, usually appear in companies, forming two lines, resembling the sides of a triangle, in the following order: the largest, which is usually a female, takes the lead; at the distance of a fathom come two others, and the remainder follow in the same order, so that if the troop consist of thirty-one, there are fifteen on each side. When their ranks are broken by a fall, a dyke, or any noise, as soon as the obstacle is surmounted, they appear again in the former order. But if they come to a net, they make a halt; some endeavour to escape underneath, or on the sides; and if one of the troop find a passage, the others follow, and form again in the same order as before. The females commonly go first, the largest of the males follow, and the rear is composed of the smallest fish. These troops are sometimes so large, that by uniting their strength, they break through the nets that oppose them, and escape. They make a great noise as they advance, keeping in the middle of the rivers, and near the surface, excepting in stormy, or very hot weather, when they retire to the bottom of the water, and pass unperceived.

Such are the remarkable long voyages of this fish. They pass, for example, from the North Sea into the Elbe, and proceed as far as Bohemia through the Mulda, and into Switzerland up the Rhine. When about to leap over a dyke or fall that opposes them, resting upon large

Alarmed at any strange noise.

stones, they take up their tails in their mouths (this, however, is contradicted by Mr. Pennant); then suddenly straitening their bodies, they strike the water with great force, and thus rise five or six feet above the surface. Near the sea, while their strength is undiminished, they are capable of springing the height of fourteen feet, and three times that distance horizontally. In leaping large falls they sometimes miscarry, as has been already observed, but after resting a short time, they make fresh efforts, till they accomplish their aim, or if convinced that it is impossible, they return by the way they came. After these leaps they always fall on their sides, holding up their heads for fear of hurting them.

When these fish perceive a sea-dog, (which is an enemy of the species) upon the coast, or hear any strange noise, they instantly return to the sea. This was the case in Sweden, in the year 1743, where the report of some pieces of artillery frightened them, and made them turn back. According to the observations of Giessler, the salmon advances but about four miles in twenty-four hours, and when the sun shines, not above half that distance, at such times amusing itself, and sporting on the surface of the water. This calculation can scarcely be correct, considering the long voyages it makes in the space of a month or six weeks. It does not enter the Rhine, for instance, before the month of February, and by the end of March it is caught at Rushiem, a

Salmon fishery on the Tweed.

small village in the territory of Baden, having in the intermediate time proceeded at least five hundred miles, reckoning all the curvatures and sinuosities of the river. When the salmon wants repose it usually seeks a large stone, against which it rests its tail; and if followed by any noise in its progress, assumes that posture till the danger seems to be past.

At the spawning time these fish become lean and emaciated, but on their return to the sea they acquire their proper bulk in a very little while; having been known to be considerably more than double their weight in about six weeks. They have been taken in England of the weight of seventy-four pounds, and in Sweden of eighty, and Denis says that he saw salmon six feet long in Louisiana. Their food consists of the smaller fish, insects, and worms; for all these are used with success, as baits, by the angler for salmon.

The following particulars relative to the salmon fishery on the river Tweed, are extracted from Mr. Pennant:

“The capture in the Tweed, about the month of July is prodigious; in a good fishery often a boat load and sometimes near two are taken in a tide; some few years ago there were above seven hundred fish taken at one haul, but from fifty to a hundred is very frequent.

“The season for fishing in the Tweed begins November the thirtieth; but the fishermen work

very little till after Christmas; it ends on Michaelmas day, yet the corporation of Berwick, who are conservators of the river, indulge the fishermen with a fortnight past that time, on account of the change of the style.

“ There are on the river forty-one considerable fisheries, extending upwards, about fourteen miles from the mouth (the others above being of no great value) which are rented for near five thousand four hundred pounds, per annum. The expense attending the servants’ wages, nets, boats, &c. amounts to five thousand pounds more, which together, make up the sum ten thousand four hundred pounds. Now in consequence, the produce must defray all, and no less than twenty times that sum of fish will effect it, so that two hundred and eight thousand salmon must be caught there one year with another.”

Scotland possesses great numbers of fine fisheries for salmon, both on its eastern and western coast. The laws against killing it were in former times so severe in that country, that the third offence was made capital, by a law of James the fourth. Ireland likewise abounds with this fish; the most considerable fishery in that part of the United kingdom is near Coleraine, at Cranna, on the river Ban, which in 1754 was rented for six hundred and twenty pounds per annum. In the year 1760, about three hundred and twenty tons were taken in this fishery. The chief English rivers for salmon are the Tyne, the Trent,

How taken—Salmon-hunting.

the Severn, and the Thames. They are sometimes taken in nets, and sometimes by means of locks or weirs, with iron or wooden gates, so placed in an angle, that being impelled by any force in a direction contrary to that of the stream they open, let the fish or whatever else pushes against them through, and again by the force of the water or their own weight, close, and prevent their return. Salmon are also killed in still water, by means of a spear with several prongs, which the fishermen use with surprising dexterity. When this is used in the night, a candle and lantern, or a wisp of straw set on fire, is carried along, to the light of which the fish collect.

One Graham, a person who farms the sea-coast fishery at Whitehaven, has adopted a successful mode of taking salmon, which he has appropriately denominated salmon-hunting. When the tide is out, and the fish are left in shallow waters, intercepted by sand-banks, near the mouth of the rivers, or when they are found in any inlets up the shore, where water is not more than from one foot to four feet in any depth, the place where they lie is to be discovered by their agitation of the pool. This man, armed with a three-pointed barbed spear, with a shaft of fifteen feet in length, mounts his horse, and plunges at a swift trot, or moderate gallop, belly-deep into the water. He makes ready his spear with both hands; when he overtakes the salmon, he lets go one hand, and with the other strikes



SALMON.

the spear, with almost unerring aim, into the fish. This done, by a turn of the hand he raises the salmon to the surface of the water, turns his horse's head to the shore, and runs the salmon on dry land without dismounting. This man says that, by the present mode, he can kill from forty to fifty in a day: ten are, however, no despicable day's work for a man and horse. His father was probably the first man that ever adopted the method of killing salmon on horse-back. (*See the annexed engraving.*)

In Norway, in the province of Christiansand, among some craggy and steep mountains, is a very remarkable and extremely dangerous salmon fishery on the river Mendel, near the bridge of Bieland, which is built on beams that project over the river. Not far from this bridge towards the north, close to a farm-house called Foss, the river precipitates itself from an over-hanging crag, and forms a very large cataract. The fishermen venture beneath the arch of this fall, floating in wicker-baskets fastened to a beam, to prevent their being swallowed up in the abyss. If this beam were to break, the fishermen would be lost, and if they fall among the rocks, which frequently happens, they are drawn out scarcely alive, below the cataract. But if the beam remain firm, they float upon their flat baskets quite under the arched rock, the hollows of which the salmon inhabit. They drive them out to the number of twenty, or upwards, and when

Mode of preserving salmon on the continent.

they appear at the aperture, they are there caught.

Since large nets have been used in Norway, the salmon fishery has become an object of considerable importance. These nets extend along the coast in the form of semicircles, or triangles and sometimes seven hundred fish are taken at a single haul. Two thousand fresh salmon are frequently carried to Bergen in one day. Great numbers of salmon are likewise caught in Sweden, in the Gulf of Bothnia, near Lapland, and also in Holland, at the mouths of the Rhine and the Maese.

A common method of preserving salmon practised on the continent, is by smoking them. For this purpose the fish is cut open, the head is cut off, and the spines of the back taken out; it is then left four days in salt, and after being cleaned and dried, is exposed to the smoke for three weeks, or a fortnight. Care must be taken to keep it in a dry place. Salmon of eighteen or twenty pounds are the most proper for smoking, small ones spoil too soon, and the large fish will not readily take the smoke.

These fish when taken out of their natural element very soon die; to preserve the flavour they must be killed as soon as they are taken out of the water. The fishermen usually pierce them near the tail with a knife, where they soon die with loss of blood. It has been observed that this fish will keep for several weeks without spoil-

Aversion to carrion and any thing red.

ing, though its flesh is extremely fat. Bloch says, that he has frequently received fresh salmon packed in straw, from the distance of above three hundred miles, and that after being exposed to the air, it has kept sweet for some weeks longer. He likewise asserts, that in the intestinal canal of the salmon is usually found a worm, two or three feet long. He also found that the roe of a fish weighing twenty pounds, contained twenty-seven thousand eight hundred and fifty eggs.

Such an abundance of different species of salmon come up the rivers of Kamtschatka, as to force the water before them, and even to dam up the streams in such a manner as sometimes to make them overflow their banks. In this case, when the water finds a passage, such multitudes are left on the dry ground as would, were it not for the violent winds so prevalent in that country, assisted by the bears and dogs, soon produce a stench sufficiently great to cause a pestilence.

These fish are said to have an aversion to any thing red, so that the fishermen are generally careful not to wear jackets or caps of that colour. Pontoppidan says also that they have so great a dislike to carrion that, if any happen to be thrown into the places where they are, they immediately forsake them: the Norwegian remedy for this is to throw into the water a lighted torch, and

General description.

this is looked upon by the inhabitants as having the desired effect.

THE TROUT.

THE general shape of the trout is rather long than broad; in several of the Scotch and Irish rivers, they grow so much thicker than in those of England, that a fish from eighteen to twenty two inches, will often weigh from three to five pounds. This is a fish of prey, has a short roundish head, blunt nose, wide mouth, filled with teeth, not only in the jaws, but on the palate and tongue; the scales are small, the back ash colour, the sides yellow, and when in season, is sprinkled all over the body and covers of the gills with small beautiful red and black spots; the tail is broad.

There are several sorts of trouts differing in their size, shape and hue; but the flesh of the best is either red or yellow, when drest; the female has a smaller head and deeper body than the male, and is of superior flavour. In fact, the colour of the trout and its spots vary greatly in different waters, and at different seasons.

This fish, although very delicate, and at present well known, was in no esteem among the ancients. It abounded in most of the lakes of

the Roman empire, yet is only mentioned by writers on account of its beautiful colours.

In some rivers trouts begin to spawn in October; but November is the chief month of spawning. About the end of September they quit the deep water to which they had retired during the hot weather, and make great efforts to gain the course of the currents, seeking out a proper place for spawning. This is always on a gravelly bottom, or where gravel and sand are mixed among stones, towards the end and sides of streams. At this period they turn black about the head and body, and become soft and unwholesome. They are never good when they are big with roe, which is contrary to the nature of most other fish. They multiply very fast, though they produce much less spawn than any other fish, which is probably owing to the voracious fish in those cold streams where they reside, and they would be still more numerous if they were not so greedy as to devour each other. After spawning they become feeble, their bodies are wasted and those beautiful spots, which before adorned them, are imperceptible. Their heads appear swelled, and their eyes are dull. In this state they seek still waters, and continue there sick, as it is supposed, all the winter. There are in all trout rivers some barren female fish, which continue good throughout the winter.

These fish begin to leave their winter quarters in March, or sometimes earlier, if the weather

Habits—Supposed term of the trout's existence.

be mild, and approach the shallows and tails of streams, where they cleanse and restore themselves. As they acquire strength they advance still higher up the rivers, till they fix on their summer residence, for which they generally chuse an eddy behind a stone, a log, or bank, that projects into the water, and against which the current drives. They also frequently get into the holes under roots of trees, or into deeps that are shaded by boughs and bushes. They are quick swimmers, and, like salmon, leap to the height of five or six feet, to surmount any obstacles in their passage.

Trouts in a good pond will grow faster than in some rivers; and a gentleman who kept them in ponds, to ascertain the progress and duration of their lives, asserts that at four or five years old they were at their full growth. For three years subsequent to this they continued with little alteration in size; two years after, the heads seemed to be enlarged, and the body wasted, and in the following winter they died. According to this computation, nine or ten years seem to be the term of their existence.

In several of the northern rivers, trouts are taken as red and as well tasted as charr; and their bones, when potted, like those of charr, have dissolved. These are often very large: one of them was caught some time ago that measured twenty-eight inches in length.—A trout was taken in the river Stour, in December 1797,

which weighed twenty-six pounds, and another, some years ago, in Lough Neagh, in Ireland, that weighed thirty pounds.

Trouts are said to be in season from March to September. They are, however, fatter from the middle to the end of August than at any other time.

This fish is not easily caught with a line, being at all times exceedingly circumspect. The baits used are worms or artificial flies. The season for fishing is from March till Michaelmas. Cloudy weather is generally preferred for angling, but there is no particular time of day.

In countries where this fish abounds, it is pickled in the same manner as salmon, or salted like the herring. At the source of the Orbe, which rises in a rock in the canton of Bern, in Switzerland, are found trouts which have the taste of crabs, and are of a very superior flavour if dressed when just taken.

In several countries the sovereigns have reserved to themselves the right of fishing for trout, and have forbidden it to be caught under severe penalties. In Saxony the fishing for it is prohibited under pain of imprisonment; in other provinces of Germany it is punished with the loss of a hand, and in the kingdom of Congo, in Africa, with death.

A variety of the trout naturally deformed, having a singular crookedness near the tail, is found

Gillaroo trout—Brown trout.

in two or three of the pools in North Wales. Some of the perch in the same country have a similar deformity. In two or three of the lakes of Ireland there is another variety called the gillaroo trout. The stomachs of these trouts are so excessively thick and muscular as to bear some resemblance to the organs in birds called gizzards. These stomachs are sometimes served up to table as trouts' gizzards. In the common trout the stomach is uncommonly strong and muscular; for as well as small fish and aquatic insects, the animals live on the shell-fish of the fresh waters; and even take into their stomachs gravel or small stones, to assist in comminuting the testaceous part of their food.

The brown trout is merely a variety of the common trout, from which it differs not only in its colour, but likewise in the place of its abode. The head is large, and of a dark brown colour. The upper jaw projects a little beyond the lower, and both of them are furnished with sharp teeth. The iris of the eye is blue, and the pupil black, with a red border. The back is round, the sides are brown, and like the head are covered with violet spots. The belly is white, and larger than that of the common trout. Like the latter, it inhabits streams whose water is pure, and cold, and which have a gravelly bottom; the only difference is, that it prefers shady brooks. Its flesh turns red when boiled, and is better tasted than

that of the common trout. In other respects it perfectly resembles that fish.

There is also in the Tweed, another kind of trout, called the bull-trout, of a large size, and proportionably longer than the whitling. This trout is found only in the months of January and February; often weighing twelve pounds, and is sold in London, during these early months, for salmon.

Another species of small fish is found in those rivers that abound with trout and salmon, and is commonly known by the name of par-fish. They appear in the month of April, and continue till November, during which time they increase from two or three inches to five or six. They are caught with worms or the artificial fly. They are most probably the same fish with the samlet of the Wye, and the samson of the Severn, both of which they resemble perfectly in shape and colour; and the same notion prevails in respect to them as of the par, that they are only of the male sex.

But the opinion of their being the fry of the salmon, or else an abortive production of that fish which does not breed, seems to be clearly negatived by Mr. Pennant. To this may be added, that near the river of Aber, in Carnarvonshire, a small stream falls perpendicularly from a rock three hundred feet high; above this fall the par, the samlet, or samson, are in great plenty,

but no salmon was ever seen above the cataract ; consequently, the species in question which are very numerous, and constantly breed there, cannot be the abortive or mature offspring of that fish.

THE SALMON-TROUT,

SO called from its resemblance to the two fish whose names it bears ; it attains the size of a small salmon, is spotted in the same manner as the trout, and like it spawns in winter. Like the salmon it sometimes inhabits the sea, and sometimes the rivers ; it likewise ascends into the latter to deposit its spawn. The salmon-trouts, however, do not quit the sea so early as the salmon, being seldom seen in the rivers before the month of May. They spawn in the same manner as salmon, in November or December ; but as the rivers are then frozen, they do not retire to the sea till after the thaw. Like all other fish of the same genus, they live upon aquatic insects, worms and small fish, and are fond of rapid streams, with a bottom of sand and gravel. Their flesh is red, and well tasted, particularly before the spawning season. Its quality depends in a great measure on

Considerable size—Quality of emitting light.

the greater or less degree of purity of the streams in which the fish are taken; their colour and spots vary extremely from the same cause. They die soon after they are taken out of the water. They are also known by the name of whitlings, and many have supposed them to be young salmon, which opinion has been proved to be ill founded.

Salmon-trouts attain a considerable size; weighing sometimes eight or ten pounds. Dr. Bloch describes one that was twenty-inches in length, an inch and a half thick, and which weighed five pounds and three quarters. This gentleman discovered, that this fish, like several kinds of sea fish, possesses the quality of emitting light in a dark place, and that the palate, tongue, gills and eyes, were endowed with that property in an eminent degree. When touched with the finger those parts cast a considerable light, and when any other part was rubbed with the same finger, that quality was likewise communicated to it. The luminous matter, the Doctor imagines is contained in the slimy substance which covers those parts, for the flesh does not afford the smallest appearance of light. He kept the fish eight days, and this luminous property diminished in proportion as the viscous-matter was dried up.

The salmon-trout is preserved by salting, pickling, and smoking. It is an excellent dish, its

Description.

flesh being tender and of a good flavour, particularly when fat. The same kind of worm, only of smaller size, is found in the intestinal canal of this fish, as in the salmon. According to Pontoppidan, the trout is subject to consumption, the head is then large, the body meagre, and the intestines covered with pustules.

THE PIKE.

THE head of the pike is very flat, the eyes small and of a gold tinge; the upper jaw broad and shorter than the lower which turns up a little at the end, and is marked with minute punctures; the teeth are very sharp, disposed not only in the point of the upper jaw, but in both sides of the lower, in the roof of the mouth, and has often three rows upon the tongue, and even down to the orifice of the stomach; the gape of the jaws is wide, although loosely connected; they have on each side an additional bone like the jaw of a viper, which renders them capable of greater distention when the prey is swallowed: the body is long, the back broad and almost square when in its best state; the belly is always white. When in high season their colours are very fine, being green, spotted with bright yellow, and the gills

Solitary fish—Extreme voracity.

are of a most vivid red ; out of season the green assumes a grey appearance, and the yellow spots turn pale. The dorsal fin is placed low on the back.

This fish was little known to the ancients. It is said to have been introduced into England in the reign of Henry VIII. and was then so rare that a pike was sold at double the price of a house lamb. This however is contradicted by the Rev. Mr. Daniel, for the reasons mentioned in our description of the carp. They are now common in most of the lakes in Europe, Lapland, and the northern parts of Persia, where they sometimes measure upwards of eight feet in length. They are solitary fish, never congregating like some of the other tribes.

Scarcely any fish of its size in the world can equal the pike in voracity. One of them has been known to choak itself in attempting to swallow another of its own species that proved too large a morsel : and it has been well authenticated that, in Lord Gower's canal at Trentham, a pike seized the head of a swan as she was feeding under water, and gorged so much of it as killed them both. Walton says, " I have been assured by my friend Mr. Seagrave, who keeps tame otters, that he has known a pike, in extreme hunger, fight with one of his otters for a carp that the otter had caught, and was then brought out of the water."

Considerable weight of some.

Boulker, in his "Art of Angling," informs us that his father caught a pike that was an ell long, and weighed thirty-five pounds, which he presented to Lord Cholmondeley. His lordship directed it to be put into a canal in his garden, which at that time contained a great quantity of fish. Twelve months afterward the water was drawn off, and it was discovered that the pike had devoured all the fish except a single large carp, that weighed between nine and ten pounds, and even this had been bitten in several places. The pike was again put in, and an entire fresh stock of fish for him to feed on; all these he devoured in less than a year. Several times he was observed by workmen, who were standing near, to draw ducks and other water-fowl under water. Crows were shot and thrown in, which he took in the presence of the men. From this time the slaughtermen had orders to feed him with the garbage of the slaughter-house; but being afterwards neglected he died, as it is supposed, for want of nutriment.

A pike was caught in the river Ouse (December 1765) that weighed upwards of twenty-eight pounds, and was sold for a guinea. When it was opened, a watch, with a black ribband and two seals, were found in its body. These, it was afterwards discovered, had belonged to a gentleman's servant, who had been drowned in the river about a month before.

Its remarkable longevity.

Marvellous accounts of the fierceness of this fish is related by various authors. Gessner says, that a famished pike in the Rhone seized on the lips of a mule, and was, in consequence, dragged out of the water; and that people, while washing their legs, had often been bitten by these voracious creatures.

The largest pike that is supposed to have been ever seen in this country, was one caught on the draining of a pool at Lillishall lime-works, near Newport, that had not been fished in the memory of man: it weighed above 170 pounds.

If the accounts of different writers on the subject are to be credited, the longevity of the pike is very remarkable. Gessner goes so far as to mention a pike whose age was ascertained to be 267 years. It was said to be caught in Suabia, in the year 1523; it was extremely large, and had a very aged appearance. On examining it, they found a brass ring in one of his nostrils, on which was read a Latin inscription, the purport of which was, "The emperor, Frederic II. has thrown me into his pond with his own hands, the 5th of October, 1262. From hence they concluded, that this pike had inhabited that pond for above 260 years. The eggs of this fish are highly unwholesome, and even dangerous; but their fat, liver, gall, and jaw-bones pulverised, are useful in physic.

The pike has been poetically styled the tyrant

Dreaded by all other fish.

of the watery plain; and, in fact, in proportion to his strength and celerity, he is the most active and voracious of the fresh water fish. He will attack every fish less than himself, and is sometimes seen choaked by attempting to swallow such as are too large a morsel. It is immaterial of what species the animal it pursues appears to be, whether of another or its own; all are indiscriminately devoured; so that every fish owes its safety to its minuteness, its celerity, or its courage: nor does the pike confine itself to feed on fish and frogs, it will draw down the water-rats and the young ducks as they are swimming about. Pikes frequently swallow fish as large as themselves, as may be seen from the instances already given in our preceding pages of their remarkable voracity. They seize them always by the head, and digest one part of their prey before they can draw into their mouths the other. What is very remarkable, the pike having ravaged a pond, will attack and devour one another. For this reason they are dreaded by all other fish; and the small ones shew the same uneasiness and detestation at the presence of their tyrant, as the little birds do at the sight of an hawk or an owl. When the pike lies asleep near the surface, as is frequently the case, the lesser fish are often observed to swim round it in vast numbers, with a mixture of caution and terror.

Affords the angler good sport.

As the pike is reckoned a good dish, his days are greatly abridged : the larger he is, the coarser the food, and *vice versa*. On the Continent, where they are caught in great abundance, they are dried, and exported to other countries for sale. They are extremely prolific; about one hundred and fifty thousand ova being found in the body of a female pike. They spawn in March or April.

Pikes afford the angler good sport, being bold biters. For trolling the rod should be twelve or fourteen feet long. The best baits are gudgeons or dace of a middling size; the bait should never be thrown too far. Pike are to be allured by a large bait, but a small one is more certain to take them. The largest pike ever known to be caught by trolling, was in Scotland in 1784, by Colonel Thornton; it wanted only two ounces of fifty pounds weight. He was an hour and a quarter on the line before he submitted to his fate. There was a wound upon the belly, from whence was taken a hook which had then worked itself through the skin; for upon the discoloured part being pressed, the hook appeared, and was extracted; and it was ascertained that he had swallowed and broke away with that hook *ten years* before.

Pike are often taken while lying asleep on the surface of the water, by means of a snare at the end of a pole gently passing over their head,

Description.

which by a sudden jerk draws close, and brings them to land.

THE EEL.

EELS have a smooth head and tubular nostrils ; their gill-membrane has ten rays ; the body is nearly cylindrical, smooth, and slippery. The tail and the back and anal fins are united : the spiracle is behind the head or the pectoral fins. —There are about nine species of the eel, most of which are found only in the seas. This fish was neglected by the Romans, but highly esteemed by the Sybarites.

The common eel forms evidently a connecting link, in the chain of nature, between the serpents and fish, possessing not only, in a great measure, the serpent form, but also many of their habits.

This fish is frequently known to quit its elements, and to wander, in the evening or night, over meadows in search of snails and other prey, or to other ponds for change of habitation. This will account for eels being found in waters that have not been in the least suspected to contain them. An instance of this rambling spirit of the eels is mentioned in Plott's Natural History of Staffordshire ; and, from the following couplet

Capable of climbing over any obstacle.

translated from Oppian, it appears to have been known to the ancients;

—————"The wand'ring eel,
Oft to the neighbouring beach will silent steal."

The eel is possessed of the power of climbing over any obstacle; for by applying their glutinous and slimy bodies to the surface of the object they desire to surmount, they creep up without difficulty. Mr. Anderson, in the *Philosophical Transactions*, says that, in June 1746, while he was viewing the flood-gates belonging to the water-works of Norwich, he observed a great number of eels sliding up them, and up the adjacent posts, to the height of five or six feet above the surface of the water. They ascended with the utmost facility, though many of the posts were perfectly dry, and quite smooth. They first thrust their heads and about half their bodies out of the water, and held them against the wood-work for some time; Mr. Anderson imagine still they found the viscosity of their bodies sufficiently thick, by exposure to the air, to support their weight. They then began to ascend directly upwards, and with as much apparent ease as if they had been sliding on level ground: this they continued till they had got into the dam above."

Anderson, in his production called "*The Bee*," relates a singular instance of the migration of young eels from one part of a river to another. "Having occasion," says our author,

Remarkable migration of young eels.

“ to be once on a visit at a friend's house on Dee-side, in Aberdeenshire, I often delighted to walk by the banks of the river. I one day observed something like a black string moving along the edge of the river in shoal water. Upon closer inspection I discovered that this was a shoal of young eels, so closely joined together as to appear, on a superficial view, one continued body moving briskly up against the stream. To avoid the retardment they experienced from the force of the current, they kept close along the water's edge the whole of the way, following all the bendings and sinuosities of the river. Where they were embayed, and in still water, the shoal dilated in breadth, so as to be sometimes near a foot broad; but when they turned a cape, where the current was strong, they were forced to occupy less space, and press close to the shore, struggling very hard till they passed it.

“ This shoal continued to move on night and day, without interruption, for several weeks. Their progress might be at the rate of about a mile an hour. It was easy to catch the animals, though they were very active and nimble. They were eels perfectly formed in every respect, but not exceeding two inches in length. I conceive that the shoal did not contain, on an average, less than from twelve to twenty in breadth; so that the number that passed on the whole, during their progress, must have been very great. Whence they came, or whither they went, I

Usual haunts—destructive to ducks.

know not. The place I remarked them at was six miles from the sea, and I am told that the same phenomenon takes place every year about the same season."

The ancients imagined that these fish were either created from mud, or that the scrapings of their bodies, which they left on the stones, were animated and became young eels: this and other extravagant notions were also entertained by some moderns.

The usual haunts of eels are in mud, among weeds, under roots or stumps of trees, or in holes in the banks or the bottom of rivers. They are partial to still water, and particularly to such as is muddy at the bottom. Here they often grow to an enormous size. One that was caught near Peterborough, in the year 1667, measured a yard and three quarters in length; and in 1799, one was taken out of the Kennet, near Newbury, which weighed fifteen pounds.

When kept in ponds they have been known to destroy young ducks. Sir John Hawkins, from a canal near his house at Twickenham, missed many of the young ducks; and, on draining, in order to clean it, great numbers of large eels were found in the mud. In the stomachs of many of them were found, undigested, the heads and part of the bodies of the victims.

Eels are viviparous, and seldom come out of their hiding-places but in the night, during which time they are taken with lines that have several

Impatient of cold—tenacious of life.

baited hooks. In winter they bury themselves deep in the mud, and, like the serpent tribe, remain in a state of torpor; and they are so impatient of cold, as eagerly to take shelter in a whisp of straw flung into a pond in severe weather. This has sometimes been practised as a mode of catching them.

These fish are so tenacious of life, that their parts will continue to move for a considerable time after they are skinned and cut into pieces; and no other fish whatever will live so long out of the water as these. Mr. Swallow having occasion to go from Petersburg to Moscow, where eels are a great rarity, ordered some to carry as a present: upon being taken out of the water, they were thrown upon the ground to be frozen, and soon appeared quite dead, and almost a piece of ice: they were then packed in snow, and when he arrived at Moscow, (which was four days after,) the eels being put into cold water, and so thawed, discovered gradually signs of life, and soon perfectly recovered.

Eels are best in season from May to July, but may be caught with a line till September. When the water is thick with rains, they may be fished for during the whole day; but the largest and best are caught by night-lines. The baits are wasp-grubs, or dew-worms, minnows, or gudgeons. The most considerable fisheries in our islands are supposed to be those on the river Ban in Ireland.

Silver eel—grig—black eel—sand-eel.

Eels vary very much in their colours, from a sooty hue, to a light olive green, and those which are termed silver eels have their bellies white, and throughout a remarkable clearness. There is another variety known in the Thames by the names of grigs, and about Oxford by that of grigs or gluts. These are scarce ever seen near Oxford in the winter, but appear in spring, and bite readily, which the common eels in the neighbourhood will not. They have a larger head, a blunter nose, thicker skin, and are less fat than the common sorts; are in less estimation, and seldom exceed three or four pounds weight. The black eel has a large head, a black back, and yellow belly; the flesh is reckoned unwholesome, especially when taken out of mud in standing waters.

The sand-eel seldom exceeds a foot in length. The head is compressed, and narrower than the body; the upper jaw is narrower than the under, the body is cylindrical with scales, hardly perceptible. There is but one species of the sand-eel, viz. the *tobianus*, or *launce*, a native of Europe. This fish gathers itself into a circle, and pierces the sand with its head in the centre. It is found in most of our sandy shores during some of the summer months; it conceals itself, on the recess of the tides, beneath the sand, in such places where the water is left, at the depth of about a foot; and is in some places dug out, and in others drawn up by means of a hook contrived

Description by the late Dr. Garden

for that purpose. They are commonly used as baits for other fish, but they are also very delicate eating. These fish are found in the stomach of the porpesse; an argument that the last roots up the sand with its nose, as hogs do the ground.

THE ELECTRIC OR NUMBING EEL, OR GYMNOTUS.

OF this extraordinary fish, which bears a great resemblance both in shape and colour to the common eel, the following very accurate description was given by the late Dr. Garden, of Charlestown, in South Carolina:

“ The largest of these fish was three feet eight inches in length, when extending itself most, and might have been from ten to fourteen inches in circumference about the thickest part of the body. The head is large, flat, smooth, and impressed here and there with holes, as if perforated with a blunt needle, especially towards the sides, where they are more regularly ranged in a line on each side. The rostrum is obtuse and rounded. The upper and lower jaws are of equal length, and the gape is large. The nostrils are two on each side, the first large and tubular, and elevated above the surface; the other small and level with the skin, placed immediately behind the verge of the rostrum, at the distance of an inch asunder. The eyes are small, flattish, and of a blueish

Of this extraordinary fish.

color, placed about three quarters of an inch behind the nostrils, and more towards the sides of the head. The whole head seems to be well supported, but whether with bones or cartilages I could not learn. The body is large, thick, and roundish, for a considerable distance from the head, and then gradually grows smaller, but at the same time deeper to the point of the tail, which is rather blunt. There are many light-colored spots on the back and sides of the body, placed at considerable distances in regular lines, but more numerous and distinct towards the tail. When the fish was swimming it measured six inches in depth near the middle, from the upper part of the back to the lower edge of the fin, and it could not be more than two inches broad on the back at that place. The whole body from about four inches below the head, seems to be clearly distinguished into four different longitudinal parts or divisions. The upper part or back is roundish, of a dark color, and separated from the other parts on each side by the lateral lines, which taking their rise at the base of the head, just above the pectoral fins, run down the sides, gradually converging, as the fish grows smaller, to the tail, and make so visible a depression or furrow in their course, as to distinguish this from the second part or division, which may be properly called the body, or at least appears to be the strong muscular part of the fish. The second division is of a lighter, and more clear blueish

Description by the late Dr. Garden

color, than the upper or back part, and seems to swell out somewhat on each side, from the depression of the lateral lines; but towards the lower or under part is again contracted, or sharpened into the third part, or carina. This carina, or keel, is very distinguishable from the other two divisions, by its thinness, its apparent laxness, and by the reticulated skin of a more grey or light color, with which it is covered. When the animal swims gently in pretty deep water, the rhomboidal reticulations of the skin of this carina, are very discernible; but when the water is shallow, or the depth of the carina is contracted, these reticulations appear like many irregular longitudinal plicæ, or folds. The carina begins about six or seven inches below the base of the head, and gradually widening, or deepening, as it goes along, reaches down to the tail where it is thinnest. It seems to be of a strong muscular nature. Where it first takes its rise from the body of the fish, it seems to be about one inch or one inch and a half thick, and is gradually sharpened to a thin edge, where the fourth and last part is situated; viz. a long, deep, soft, wavy fin, which takes its rise about three or four inches at most below the head, and runs down along the sharp edge of the carina to the extremity of the tail. When it first rises it is not deep, but gradually deepens or widens as it approaches the tail. It is of a very pliable, soft consistence, and seems rather longer than the body. The

Of this extraordinary fish.

situation of the vent in this fish is very singular, being placed underneath, and being about an inch more forward than the pectoral fins, and consequently considerably nearer the rostrum.

“ There are two pectoral fins, (if I may call them so,) placed one on each side, just behind the head, over the foramina spiratoria, which are small, and generally covered with a lax skin, situated in the axillæ of these fins. These fins are small for the size of the fish, being scarcely an inch in length, and of a very thin delicate consistence, and orbicular shape. They seem to be chiefly used in supporting and raising the head of the fish when he wants to breathe, which he does every four or five minutes, by raising his mouth out of the water. This shews that he has lungs and is amphibious, and the foramina spiratoria seem to indicate his having branchiæ likewise; but this I only offer as a conjecture, not being certain of the fact. I must now mention the appearances of a number of small cross bands, annular divisions, or rather wrinkles of the skin of the body. They reach across the body down to the base of the carina on each side; but those that cross the back seem to terminate at the lateral lines, where new rings take their rise, not exactly in the same line, and run down to the carina. This gives the fish somewhat of a worm-like appearance; and, indeed, it seems to have some of the properties of this tribe; for it has a power of lengthening or shortening its

Possessing some properties of worms.

body to a certain degree for its own conveniency, or agreeably to its own inclination. I have seen this specimen, which I have measured three feet eight inches, shorten himself to three feet two inches; but besides this power of lengthening or shortening his body, he can swim forwards or backwards, with apparently equal ease to himself, which is another property of the vermicular tribe. When he swims forwards, the undulations or wavy motions of the fin and carina begin from the upper part, and move downwards; but when he swims backwards and the tail goes foremost, the undulations of the fin begin at the extremity of the tail, or fin, and proceed in succession from that backwards to the upper part of the body: in either case he swims equally swift. Every now and then the fish lays himself on one side, as it were, to rest himself, and then the four divisions of the body above-mentioned are very distinctly seen; viz. the vermiform appearance of the two upper divisions; the retiform appearance of the carina; and the last, or dark colored fin, whose rays seem to be exceedingly soft or flexible, and certainly at the command of the strong muscular carina. When he is taken out of the water, and laid on his belly, the carina and fin lie on one side, in the same manner as the ventral fin of the tetraodon does when he creeps on the ground."

This fish delights in clear water, and for this reason keeps near the stony shores of the sea and the mouths of rivers, which it likewise ascends,

Its singular power of electrifying.

and sometimes ventures into the lakes with which they communicate. It frequently comes to the surface of the water to fetch breath, and when deprived of fresh air it soon dies. Its flesh is fat and of a good flavor; that of the back is firm and full of small bones; but that of the belly is soft and of a glutinous quality. It is eaten both by the whites and the negroes. The peculiar species of electricity, or galvanism, exerted at pleasure by this singular animal, has, with justice, attracted the attention of naturalists. Torpedo-like, it gives a shock to any body, or number of bodies connected together.

Mr. Richer, who, in 1671, was sent to Cayenne, by the Academy of Paris, to conduct some mathematical observations, was the first that made known the wonderful properties of the electric eel to the philosophers of Europe. "I was greatly surprised," says he, "to see a fish three or four feet in length, resembling an eel, which, when touched with a finger, or even with a stick, benumbed the arm and the part of the body next to it, in such a manner that any person making the experiment remained a quarter of an hour without being able to move it. I was an eye-witness of this effect, and have even felt it myself, having one day touched with my finger a fish of this kind that was still alive, and in the possession of some savages, who had wounded it with an arrow, by means of which they had it out of the water. I could not learn the name

Remarks by Messrs. Ingram and Gravesend.

of the fish from them: they say that it strikes the other fish with its tail, by which it benumbs, and afterwards devours them; which is very probable, considering the effect which it produces on men when they touch it."

Richer's account, however, was received with such a degree of cautious scepticism in Europe, that, for seventy years, not the smallest notice was taken of this fish by any naturalist, till about the middle of the last century, M. de la Condamine, in his "Travels in America," mentions a fish producing the same effects as that described by Richer. In a letter, (dated February, 1750,) Mr. Ingram furnished some more authentic information relating to this fish, which he calls the torpedo; though from his description it is obvious that he alluded to the electric eel. He imagined that the fish probably has an electric atmosphere around it, because when he offered to touch it with a piece of iron, his arm felt such a violent shock before it came in contact, that he was obliged to drop the iron. But Mr. Gravesend first discovered that this shock was caused by electric matter. In a letter to Professor Allemand, dated Rio Issequebo, 22d of November, 1755, he says:—

"This fish produces the same effect as an electric shock communicated by the Leyden jar, but with this difference, that no spark is observed let the shock be ever so strong: for if the fish be large it infallibly knocks down those who touch

Undeniable proofs of its electricity.

it, and they feel the shock through the whole body."

Gronovius soon afterwards published some experiments, which an acquaintance of his had made in America upon an eel of this kind, which prove undeniably the animal electricity of the fish. By these experiments it likewise appeared that the electric fluid is communicable to several persons, if the first touch the head of the fish, and the last, who must be at a certain distance, hold one hand in water; but that no shock is conveyed when the fish is touched with electric substances, as sealing-wax or silk. Muschenbröck, who was an advocate of animal electricity, acquainted his friend Nollet with these circumstances. Still, however, great doubts were entertained of the existence of that fluid, and the singular effects produced by this fish were attributed to certain muscles, of the same nature as those which Reaumur asserted that he discovered in the torpedo. Not long after, an additional argument in favor of animal electricity was furnished by the experiments of Vander Lott, who shewed that by touching this fish with different metals a powerful shock was felt, but that none was perceived if it were touched with sealing wax, &c. Fermin went still farther; he proved by experiment that fourteen slaves, who had hold of each other, felt the shock at the same time, when the first touched the fish with a stick, and the last

held his hand in water. The experiment of Dr. Bancroft were equally satisfactory.

Dr. Williamson, in a letter inserted in the Philosophical Transactions, says, that on touching an electrical eel with one hand, a sensation is experienced similar to that arising from touching the conductor of an electrical machine; with a short iron rod the same was felt, but less powerfully. While another person provoked the fish, Dr. Williamson put his hand into the water, at the distance of three feet from it, and felt an unpleasant sensation in the joints of his fingers. Some small fish were thrown into the water, and the animal immediately stunned and swallowed them. A larger fish was thrown in, which he stunned likewise, and attempted to swallow, but from its size he could not do it. Dr. Williamson put his hand into the water, and had another fish thrown in at some distance. The eel swam up to it, and at first turned away without offering it any violence; after a little time he returned, and looking stedfastly at it a few seconds, gave it a shock, by which it instantly turned upon its back, and became motionless. Dr. W. at that very instant felt the same sensation in his fingers as when he put his hand into the water before. A fish was afterwards struck, but not quite killed; when the electric eel perceived this he returned, and at a second shock, evidently more severe than the former, rendered it motionless. On

Extraordinary instance recorded by Mr. Bryant.

touching it with one hand so as to provoke it, and holding the other in the water at a little distance, a severe shock was felt through both the arms, and across the breast, similar to that from a charged jar. Eight or ten persons, with their hands joined, experienced the same, on the first touching the head, and the last the tail of the fish. A dog being made a link in this chain, at the instant of contact uttered a loud yell. When the eel was touched with silk, glass, or any other non-conductor, no shock whatever was felt. From a long series of experiments, it appeared to Dr. Williamson that these properties partook so nearly of the nature of electricity, that whatever would convey the electrical fluid would also convey the fluid discharged by the eel, and *vice versa*. He, however, was never able to observe that any spark was produced on contact. This mode of defence the fish never adopted except it was irritated; and the doctor has passed his hand along the back and sides from head to tail, and even lifted part of its body out of the water, without tempting it to injure him.

Mr. Bryant, in a letter also inserted in the Phil. Trans. mentions an instance of the shock being felt through a considerable thickness of wood. One morning, while he was standing by, as a servant was emptying a tub, in which one of these fish was contained, he had lifted it entirely from the ground, and was pouring off the water to renew it, when he received a shock so violent

Consequences of touching this fish.

as occasioned him to let the tub fall. Mr. Bryant then called another person to his assistance, and caused them together to lift up the tub, each laying hold only on the outside. When they were pouring off the remainder of the water, they each received a shock so smart that they were compelled to desist.

Many have been knocked down with the sudden stroke. One of these fish being shaken from a net upon grass, an English sailor, notwithstanding all the persuasions that were used to prevent him, would insist on taking it up; but the moment he grasped it he dropped down in a fit, his eyes were fixed, his face became livid, and it was not without difficulty that his senses were restored. He said that the instant he touched it, "the cold ran swiftly up his arm into his body, and pierced him to the heart."

Likewise a negro, who attempted to grasp a large fish firmly with his hands, had, in consequence, a confirmed paralysis in both his arms, as recorded by Mr. Flagg.

Dr. Garden, speaking of the singular property of this fish, says, "the person who is to receive the shock must take the fish with both hands, at some considerable distance asunder, so as to form the communication; otherwise he will not receive it; at least I never saw any one shocked from taking hold of it with one hand only; though some have assured me that they were shocked by laying one hand on him. I myself have taken

Remarks on these electric shocks.

hold of the largest with one hand often, without ever receiving a shock; but I never touched it with both hands, at a little distance asunder, without feeling a smart shock. I have often remarked, that when it is taken hold of with one hand, and the other hand is put into the water over its body, without touching it, the person received a smart shock; and I have observed the same effect follow, when a number joined hands, and the person at one extremity of the circle took hold of, or touched the fish, and the person at the other extremity put his hand into the water over the body of the fish. The shock was communicated through the whole circle as smartly as if both the extreme persons had touched the fish. In this, it seems to differ widely from the torpedo, or else we are much misinformed of the manner in which the benumbing effect of that fish is communicated. The shock which our Surinam fish gives, seems to be wholly electrical; and all the phenomena, or properties of it, exactly resemble those of the electric aura of our atmosphere, when collected, as far as they are discoverable from the several trials made on this fish. This stroke is communicated by the same conductors, and intercepted by the interposition of the same original electric, or electric *per se*, as they are called. The keeper of these fish informed me, that he caught them in Surinam river, a great way up, beyond where the

Observations by Dr. Garden,

salt water reaches, and that they are a fresh water fish only. He says, that they are eaten, and by some people esteemed a great delicacy. They live on fish, worms, or any animal food, if it is cut small so that they can swallow it. When small live fish are thrown into the water, they first give them a shock, which kills or so stupifies them, that they can swallow them easily, and without any trouble. If one of these small fish after it is shocked, and to all appearance dead, be taken out of the vessel where the electrical fish is, and put into fresh water, it will soon revive again. If a larger fish than they can swallow be thrown into the water at a time when they are hungry, they give him some smart shocks, till he is apparently dead, and then endeavor to swallow or suck him in ; but after several attempts, finding he is too large, they quit him. Upon the most careful inspection of such fish, I could never see any mark of teeth, or the least wound or scratch upon them. When the electrical fish are hungry, they are pretty keen after their food ; but they are soon satisfied, not being able to contain much at a time. An electrical fish of three feet and upwards in length, cannot swallow a fish above three, or at most three inches and a half long. I am told, that the electrical fish is sometimes found in the river Surinam, upwards of twenty feet in length, and that the stroke, or shock, proves instant death to the person who receives it."

By Capt. Stedman, and Mr. Hunter.

Captain Stedman's account differs from the above in one material point: he says, that it is by no means necessary to grasp the animal with both hands to receive the shock, having himself experienced the contrary effect. For a small wager he attempted several times to seize an electrical eel with one hand, and at every trial he had a severe shock, which extended to the top of his shoulder; and after about twenty different attempts, to no purpose, he was compelled to desist.

Mr. Hunter, in his ingenious investigation of this animal, observes that the organs which produce this wonderful accumulation of electric matter, constitute nearly one half of that part of the flesh in which they are placed, and, perhaps, compose more than one third of the whole animal. There are two pairs of these organs, one on each side. Their structure is very simple and regular, consisting only of flat partitions, with cross divisions between them. The partitions are thin membranes placed nearly parallel to one another, and of different lengths and breadths. Their distances from each other differ with the size of the fish; in one of two feet four inches in length they were found to be one twenty-ninth of an inch asunder. They appear to answer the same purpose with the columns of the torpedo, making walls or butments for the subdivisions, and are to be considered as forming so many

Electric sparks produced by Mr. Walsh.

distinct organs ; they are very tender, and easily lacerated. These are furnished with many pairs of nerves appropriated to their management ; but how these surprising effects are produced by means of such organs, in a fluid also extremely ill-adapted to the purpose, has not, nor perhaps ever will be ascertained.

Notwithstanding the existence of the electrical property was proved by these experiments in a most satisfactory manner, many naturalists still maintained a contrary opinion because there was no visible spark. Mr. Walsh, celebrated for his observations on the electricity of the torpedo, was unable to produce any spark from that fish. That gentleman, however, having obtained four electric eels from Surinam, at length succeeded in rendering the sparks visible, and describes the method in a letter to M. le Roi. He laid a piece of metal, cut into two parts, upon glass ; the fish being then taken out of the water and excited, he distinctly saw the electric sparks pass from one piece of metal to the other. There can be no doubt of the accuracy of this experiment, for Sir John Pringle and Mr. Magellan likewise assured M. le Roi that they, as well as several other persons, had seen the sparks pass as above described, and that the experiment was repeated ten or twelve times with the same result. Mr. Magellan adds, that twenty-seven of the company, taking hold of each other's hands, formed a circle,

How taken and kept.

and the person at one extremity having touched the eel, they all received a shock similar to that produced by a Leyden vial.

This fish is taken in nets, and when the fishermen have caught a large one they kill it with a club, to prevent being exposed to the effects of its electric property. At Surinam young ones are kept in capacious vessels made for the purpose, and are fed with small fish or worms. Insects are their favorite food; these they swallow with great avidity the moment they are thrown into the water. A considerable quantity of viscous matter oozes from the skin of this fish, which renders it necessary to change the water at least once a day. A pipe is affixed to the vessel, by means of which the water is drawn off: on this occasion the fish is sometimes left whole hours dry and motionless, but yet if touched in this state it communicates as strong a shock as before.

Notwithstanding Dr. Garden's assertion, that specimens of the electric eel have been seen that were upwards of twenty feet in length, and whose shocks would be instant death to any man who unfortunately received it; yet Captain Stedman, who, from his long residence in South America, where these fish are principally found, was enabled to make accurate enquiries on the subject, contradicts this gentleman.

THE GRAYLING

IS a fish of very elegant form ; the body is less deep than that of the trout ; the head small, with protuberant eyes, the irides of which are silvery, speckled with yellow ; the mouth is of a middle size, and the upper jaw the largest. The teeth are very minute, seated in the jaws and roof of the mouth, and feel like a fine file ; the head is dusky, the covers of the gills of a glossy green, yet when in prime perfection, these parts are blackish, (differing in this respect from all other fish, being least beautiful when most in season) ; the back is of a dusky green, inclining to blue ; the sides of a fine silvery grey (from which it derives its name) ; yet when first taken they seem to glitter with spangles of gold, and are marked with black spots irregularly placed. The side line is nearly straight ; the scales are large, and the lower edges dusky, forming straight rows from the head to the tail, which is much forked ; the large dorsal fin is spotted, the other fins are plain ; it is rather hog-backed, and, from the nose and belly touching the ground together, it is supposed that this fish feeds mostly at the bottom.

The grayling haunts rapid and clear streams, particularly such as flow from mountainous countries : it is found in those of Derbyshire, Shropshire, Yorkshire, &c. In Lapland, (where it is very common,) the inhabitants use its entrails,

Much esteemed—how to be angled for.

instead of rennet, to make the cheese, which they get from the milk of the rein-deer. The grayling seldom exceeds sixteen inches in length. We are told by Pennant, as a singular instance, that one was taken near Ludlow which was about half a yard long, and weighing four pounds, six ounces. Near Shrewsbury, however, one was caught which weighed full five pounds.

These fish are in great esteem, and their flesh is white and palatable all the year. They are in season from September to January, (some say they are best in October, others in December,) and cannot be dressed too soon after they are caught. Graylings lurk close all the winter, and begin to be very active, and to spawn in April or early in May; at which time, and during the summer, near the sides and at the tails of sharp streams, they will take all the flies that trout are fond of: they rise bolder than the trout, and if missed several times, will still pursue; but though so sportive after the fly, yet when hooked they are quite inanimate, and the sides of the mouth are so very tender, that unless nicely treated when struck, the hold will frequently be broken. In September they retire to the lower end of still holes, just where the water becomes shallow, where they will take a fly at the top, which should be small. Walton says that they will take a minnow, but experienced anglers have never found this bait successful. These fish bite during the whole of cool, cloudy days; but the

Description.

preferable time in spring and summer are from eight in the morn until twelve, and from four in the afternoon until after sunset; and from September to January in the middle of the day.

As the grayling is so swift a swimmer, as to disappear like the passing shadow, it is by some called the umbra; and by others, on account of an imaginary scent proceeding from it similar to that of thyme, it is also named thymallus.

THE COD.

THE head in the cod fish is smooth; the color on the back and sides is of a dusky olive, variegated with yellow spots; its belly is white; its sides have a long white line running their whole length, from the gills to the tail, which at the abdomen is curved, but elsewhere is straight; its scales are very small, and adhere firmly to the skin; its eyes are large; at the angle of the lower jaws there hangs a single beard, which is short, seldom exceeding a finger's length; its tongue is broad; it has several rows of teeth, like the pike; and in the palate, near the orifice of the stomach, and near the gills, it has small clusters of teeth. It has three back fins, two at the gills, and two at the breast, and two others behind the anus; and the tail is plain.

These fish are found only in the seas of the northern parts of the world; and the great ren-

Favorite situations—Chief fisheries.

devious for them are the sand-banks of Newfoundland, Nova Scotia, and New England. These shallows are their favorite situations; for here they are able to obtain great quantities of worms, a food that is peculiarly grateful to them. Another cause of their attachment to these places is their vicinity to the polar seas, where they return to spawn. There they deposit their roes in full security, and afterwards repair, as soon as the first more southern seas are open, to the banks for subsistence; consequently the cod may justly be placed at the head of the migrating, or wandering tribe of fish. Few are taken north of Iceland, and the shoals never reach so far south as the straits of Gibraltar.

Previous to the discovery of Newfoundland, the principal fisheries for cod were in the seas off Iceland, and off the western islands of Scotland. To the former of these the English resorted near four centuries, and had no fewer than one hundred and fifty vessels employed in the Iceland fishery in the reign of James I.

At present the chief fisheries are in the bay of Canada, on the great bank of Newfoundland, and off the isle of St. Peter, and the isle of Sable. The vessels frequenting these fisheries are of from a hundred to two hundred tons burthen, and will catch 30,000 cod or upwards each. The hook and line are the only implements used to take the fish; and this in a depth of water of from

Newfoundland fishery.

sixteen to sixty fathoms. The great bank of Newfoundland is represented to be like a vast mountain, above five hundred miles long, and near three hundred broad; and the number of British seamen employed upon it is supposed to be about fifteen thousand. The best season for fishing is from the beginning of February to the end of April; and though each fisherman takes no more than one fish at a time, an expert hand will sometimes catch four hundred in a day. The employment is excessively fatiguing, from the extreme coldness of the climate, and the immense weight of the fish. The heads of the cod, as soon as they are caught, are cut off; they are opened, gutted, and salted; they are then stowed in the hold of the vessel, in beds five or six yards square, head to tail, with a layer of salt to each layer of fish. When they have lain here three or four days to drain off the water, they are shifted into a different part of the vessel, and again salted. Here they remain till the vessel is loaded. Sometimes they are cut into thick pieces, and packed in barrels, for the greater convenience of carriage.

In the Newfoundland fishery, the sounds, or air-bladders, are taken out previously to incipient putrefaction, washed from their slime, and salted for exportation. The tongues are also cured, and brought in barrels containing four or five hundred pounds weight each. From the livers a great quantity of oil is extracted.

How taken by the natives of Norway.

The natives of Norway take this fish off their own coast, in strong pack-thread nets, which have meshes four inches square, and are about a fathom or fifteen meshes deep, and twenty fathom long. They use, according to the weather, from eighteen to twenty-four of these nets joined, so that they have sometimes upwards of four hundred fathom of net out at a time. They fish in from fifty to seventy fathom water, and mark the places of the nets by means of buoys. The afternoon is the time when the nets are generally set; and, on taking them in on the following morning, it is no uncommon thing to obtain three or four hundred fine cod.

In Lapland and some of the districts of Norway, the cod and torsk, (another species of this fish,) which are taken in the winter, are carefully piled up, as they are caught, in buildings constructed for the purpose, having their sides open, and exposed to the air. Here they remain frozen until the following spring, when the weather becoming more mild, they are removed to another building of a like construction, in which they are prepared for drying. The heads are cut off, and the entrails taken out, and the remainder of the body is hung up in the air. Fish caught in the spring are immediately conveyed to the second house, and dried in the above manner. Those that are caught during the summer season, on account of the heat of the weather can only be

General food—Extreme fecundity.

preserved by the common methods of curing with salt.

Cod feed principally on the smaller species of the scaly tribes, on worms, shell-fish, and crabs; and their digestion is sufficiently powerful to dissolve the greatest part even of the shells which they swallow. They are very voracious, and catch at any small body they observe moved by the water, even stones and pebbles, which are often found in their stomachs.

These fish are so extremely prolific, that Leeuwenhoek counted above nine millions of eggs in the roe of a middling-sized cod fish. In the European seas they begin to spawn in January, and they deposit their eggs in rough ground among rocks. Some continue in roe till the beginning of April. They recover very quickly after spawning, and good fish are to be taken all the summer. When they are out of season, they are thin-tailed and lousy.

Cod frequently grow to a very great size; the usual weight being from fourteen to forty pounds. The largest that is known to have been taken in this kingdom was at Scarborough, in the year 1775; it measured five feet eight inches in length, and five feet in circumference, and weighed seventy-eight pounds.

Cod fish are chosen for the table, by their plumpness and roundness near the tail; by the depth of the hollow behind the head, and by the

Description—Numerous on the Yorkshire coasts.

regular undulated appearance of the sides, as if they were ribbed. The glutinous parts about the head lose their delicate flavor after the fish has been twenty-four hours out of the water.

THE HADDOCK.

THIS well-known fish is a species of the cod; it has a bearded mouth, and three fins on the back; the upper jaw longest, and the tail a little forked. On each side of the body, just beyond the gills, there is a dark spot, which the superstitious assert is the impression of St. Peter's finger and thumb, when he took the tribute money (at the command of his master) out of the mouth of a fish of this species, and which has ever since been continued to the whole race of haddocks.

Immense shoals of this fish arrive on the Yorkshire coasts about the middle of winter; which are sometimes known to extend from the shore near three miles in breadth, and in length from Flamborough head to Tinmouth castle, near fifty miles, and perhaps even much farther northwards. The Rev. Mr. Bingley relates the following circumstance, in order to give an idea of their numbers:—"Three fishermen, within a mile of the harbor of Scarborough, frequently loaded their boat with them twice a day, taking each time about a ton of fish." The large ones quit

When in and out of season—Whiting.

the coast as soon as they are out of season, and leave behind them great plenty of small ones :--- the former are supposed to visit the coasts of Hamburgh and Jutland during the summer.

Haddocks seldom grow to any great size ; they very rarely become so large as to weigh twelve or fourteen pounds ; and they are esteemed more delicate eating when they do not exceed three pounds in weight.

These fish, during stormy weather, are said to take shelter in the sand or mud, or among the sea-weeds. They feed on various small marine animals, and frequently become fat on herrings. The females deposit their spawn on the sea-weeds near the shore.

The larger ones begin to be in roe in November, and continue so for somewhat more than two months ; from this time till May they are reckoned out of season, and are not good. They then begin to recover. The small ones are extremely good from May till February ; and those that are not old enough to breed, for even two months afterwards.

The whiting is another species of the cod, but without a beard.

THE LOACH

IS a slimy fish, without scales, and of rather a long make ; the mouth is small, placed beneath,

Description—Where found.

and has no teeth; it is bearded like the gudgeon and the barbel, having on the upper mandible six small beards, one at each corner of the mouth, and four at the end of the nose. The color of the head, back, and sides, is in some white, in others of a dirty yellow, very elegantly marked with large spots, consisting of numberless minute black specks: the pectoral, dorsal, and caudal fins are also spotted, the belly and ventral fins of a pure white, the tail broad and rather rounded. The eyes are in the upper part of the head; the gill-covering membrane has from four to five rays; and the body, which is smooth and slippery, is nearly of an equal thickness throughout.

The loach is found in several of our small rivers, keeping at the bottom on the gravel, upon which it feeds, and on that account is in some places called the groundling. It is frequent in the stream near Amersbury in Wiltshire, where the sportsmen, through frolic, swallow it down alive in a glass of white wine. The flesh is singularly nutritious, and from that circumstance, and from its being grateful to the palate, it is recommended to the sick. One of the largest ever heard of by Mr. Pennant was four inches and three-quarters in length, but they seldom exceed three inches. The females are generally full of spawn during the summer. This fish, (which is used as a bait for others, particularly

Two species—The hepsetus and menidea.

for eels,) is taken with a small red worm, the bait touching the ground.

THE SMELT.

THERE are two species of this soft-finned, abdominal fish; which derives its name from having, in the opinion of some, the scent of a violet, of others, that of a cucumber; and so strange is the disagreement respecting the smell of this fish, that the Germans bestowed upon it the name of stinck-fish. In Wales and the north of England, it bears the name of sparling, derived from the French *eperlan*.

The first species, called the hepsetus, has about twelve rays in the fin next the anus. It is found in the northern seas, and is very plentiful in the sea near Southampton, as well as on other coasts of our island. The length is about five inches, and the tail is much forked. It is a beautiful little fish, semi-pellucid, covered with scales; the color silvery, tinged with yellow; beneath the side line is a row of small black spots, and the under jaws rather prominent; in the front of the upper are four large teeth; the tail is forked; the flesh is tender, and of a delicate taste.

The other species, called the menidea, has twenty-four rays in the fin next the anus. This is a very small pellucid fish, with many black

points interspersed; it has many teeth in the lips, but none in the tongue or jaws. It is found in the fresh waters of Carolina.

“This fish,” says Mr. Pennant, speaking in general terms of the smelt, “inhabits the seas of the northern parts of Europe; but, he believes, is never found so far south as the Mediterranean: the Seine is one of the French rivers which receive it; but whether it is found south of that there is no authority to decide. If the observations of navigators, (who have generally too much to engage their attention, to think much of the minutiae of natural history,) can be depended upon, smelts are taken in the Straits of Magellan measuring *twenty* inches in length, and *eight* in circumference.

“They are met with in the seas that wash our coasts the whole year, and seldom go far from shore, except when they ascend the rivers, which they do with the tide, and in proof of which it is remarked, that they appear a long time before they spawn, being taken in abundance in the Thames and Dee in November and two succeeding months; in other rivers not until February, and in March and April they spawn, and are very prolific: after which they all return to the salt water, and are not seen in the rivers till the next season. It has been observed, that they never come into the Mersey, so long as there is any snow water in its current; and that in spring and the beginning of summer they will run far-

Of various sizes—How angled for.

ther up than in the decline of the year; they are also to be met with in the docks that are opened for the reception of ships. The smelt is of a very beautiful form and color, the head is transparent, and the skin in general so thin, that with a good microscope the circulation of its blood may be seen."

These fish vary greatly in size; the largest Mr. Pennant ever heard of was thirteen inches long, and weighed half a pound.

We are told by Walton, that some years ago, in the month of August, such vast quantities of smelts came up the Thames, that women and children became anglers for them; and that in one day, between London Bridge and Greenwich, no fewer than two thousand persons were thus employed.

The smelt is to be angled for (when the tide runs up is preferable) with a paternoster line, having five or six hooks so many inches from each other, and baited differently. The best baits are very small shrimps not boiled, or the tail of a boiled one; next to these are gentles and red pasté; also that made of boiled shrimps, fine white bread, and a little honey, cadis, blood-worms; and they will sometimes take a bit of their own species. Some crumbs of bread should now and then be thrown in to keep them together.

CHAP. VIII.

“ ——— The lavish slave
Six thousand pieces for a *mullet* gave,
A sesterce for each pound.”

DRYDEN.

THE MULLET.

MULLETS are something like dace in their shape, but much thicker. The head is almost square, and flat on the top; the nose blunt and lips thick; they have no teeth, only the upper lip is a little rough, as is also the tongue; between the eyes and the mouth is a hard callous; the pupil of the eye is black, encircled with a small silvery line; the color of the back is dusky, varied with blue and green; the sides silvery, marked with broad dusky parallel lines, reaching from head to tail, which is much forked. The scales are large and deciduous, and are also upon the covers of the gills and head, and extend as far as the nostrils. The largest are nearly half a yard long, and the flesh is excellent.

Highly esteemed by the Romans.

The red mullet, among others, was highly esteemed by the luxurious Romans, who valued it in proportion to its size, not that the larger was more delicious, but being more difficult to be procured. Horace tells us that Austurius Celer, a man of consular dignity, gave at the rate of 64l. 11s. 8d. for one; and that mentioned by Juvenal, (see the motto to this chapter,) cost 48l. 8s. 9d. It was common for a Roman to insist upon the fish being brought before him, that he might see him breathe his last, and thus have ocular demonstration of its value. Indeed Seneca says, that the mullet was not worth a farthing, except it died in the hand of the guest. Such was the luxury of the times, that there were stews even in the eating rooms, so that the fish could at once be brought from beneath the table, and placed upon it, where the mullets were put in transparent vases, that when expiring the changes of their rich color might entertain the company, who all agreed that nothing was more *beautiful* than a dying mullet. Apicius had the art of preparing them for the table in a manner still more acceptable to these epicures, by suffocating them in the exquisite Carthaginian pickle, and afterwards procuring a rich sauce from their livers.

These fish are found in great plenty on several of our sandy coasts, and they particularly haunt those small bays that have influxes of fresh water. They come in great shoals into the rivers

with the tide during the summer, and keep rooting like hogs in the sand or mud, leaving their traces in large round holes, but return back when the water ebbs, never stopping in the rivers. They are very cunning, and when surrounded with a net, the whole shoal frequently escapes by leaping over it, for when one takes the lead, the others are sure to follow.

Mullets are to be angled for as the tide comes in, before the water gets thick, with the same artificial flies as are used for trout in preference to any other bait. When the water is discolored, the angler should use a small red worm, or gentles, and fish, within two feet of the bottom, with strong tackle, as the mullet, when hooked, will struggle vigorously.

Near Martigues, in the south of France, abundance of this fish are taken in weirs made of reeds placed in the shallows; of the milts of the males, (which are there called alletants,) and of the roes of the females, (called botar,) is made boturgo: the materials are taken out entire, covered with salt for four or five hours, then slightly pressed between two boards, washed, and at last dried in the sun for fourteen days.

The best kind comes from Tunis, in Barbary; it must be chosen dry and reddish. The people of Provence use a great deal of it, the common way of eating it being with olive oil and lemon juice. There is also a great consumption of it through the Levant.

Description—Imperceptible in the sand.

THE TURBOT.

THE turbot, like some others of the flat-fish, grows to a great size. Flat-fish swim sideways, on which account they are styled pleuronectes by Linnæus. The eyes of all of them are situated on one side of the head, and it is a curious circumstance, that while the under parts of their body are of a brilliant white, the upper parts are so colored and speckled as, when they are half immersed in the sand or mud, to render them imperceptible. Of this resemblance they are so conscious, that whenever they find themselves in danger, they sink into the mud, and continue perfectly motionless. This is a circumstance so well known to fishermen, that within their palings on the strand they are often under the necessity of tracing furrows with a kind of iron sickle, to detect by the touch what they are not otherwise able to distinguish. Not being rapacious, or furnished with any weapons of defence, these fish owe their security to this stratagem; while the thornback and rays, that are carnivorous and armed with strong spines, although flat-fish of a different class, are marbled with lighter colours, that they may be perceived and avoided by less powerful fish.

Turbot and holibut are in many parts of this country sold indiscriminately for each other; they are, however, perfectly distinct, the upper parts of the former being marked with large, un-

Manner of fishing off the Yorkshire coast.

equal, and obtuse tubercles, while those of the other are quite smooth, and covered with oblong soft scales, that firmly adhere to the body. The greatest weight of the turbot is about thirty pounds.

In the northern parts of the English coast, and some places off the coast of Holland, turbots are found in greater abundance and excellence than in any other parts of the world. Lying here, however, in deep waters, they are seldom to be caught but by lines.

The manner of fishing for turbot off the Yorkshire coast is as follows; three men go out in each of the boats, each man provided with three lines; every one of which is furnished with two hundred and eighty hooks, placed exactly six feet two inches asunder. These are coiled on an oblong piece of wicker-work, with the hooks baited, and placed very regularly in the centre of the coil. When they are used, the nine are generally fastened together so as to form one line with above two thousand hooks, and extending near three miles in length. This is always laid across the current. An anchor and buoy are fixed at the end of each man's line. The tides run here so rapidly, that the fishermen can only shoot and haul their lines in the still water at the turn of the tide; and therefore, as it is flood and ebb about every alternate six hours, this is the longest time the lines can remain on the ground. When the lines are laid, two of the men usually

General bait for taking turbot.

wrap themselves in the sail and sleep, whilst the third is on watch to prevent their being run down by ships, and to observe the weather; for sometimes storms come on so suddenly, that they find it difficult to gain the shore even without their lines. The boats for this purpose are each about a ton burthen; somewhat more than twenty feet in length, and about five in width. They are well constructed for encountering a boisterous sea, and have three pair of oars, and a sail, to be used as occasion requires. Sometimes larger boats than these are used, which carry six men and a boy. When the latter come to the fishing-ground, they put out two of the smaller boats that they have on board, which fish in the same manner as the three manned boats do, save that each man is provided with a double quantity of lines; and instead of waiting in these the return of the tide, they return to the large boat, and bait their other lines; thus hauling one set and shooting another at every turn of the tide. The fishermen commonly run into harbor twice a week to deliver their fish.

The general bait used for taking turbot is fresh herring cut into proper-sized pieces, which they bite most readily; they are also partial to the smaller lampreys, pieces of haddock, sandworms, muscles, and limpets; and when none of these are to be had, the fishermen use bullock's liver. They are so extremely delicate in their choice of baits, as not to touch a piece of herring

Mode of tanning nets—Description.

or haddock that has been twelve hours out of the sea.

The hooks are two inches and a half long in the shank, and near an inch wide betwixt the shank and the point. They are fastened to the lines upon sneads of twisted horse-hair, twenty-seven inches in length. The line is made of small cording, and is always tanned before it is used.

For tanning nets a quantity of oak bark is boiled; the liquor is then strained off, and further boiled till it has contained such a consistence, that, when a little is dropped on the thumb nail it will become thick as it cools. The nets are then put into a large vessel, and this liquor is poured while hot upon them. They are suffered to lie four-and-twenty hours, when they are taken out and dried. The same process is repeated three times. Nets that have undergone this operation, are supposed to last thrice as long as they would without it.

 THE SOLE.

THIS well-known and delicious fish is remarkable for one very extraordinary circumstance; among various other marine productions, they have been known to feed on shell-fish, although they are furnished with no apparatus whatever in their mouth for reducing them to a state cal-

Extraordinary food—Where found—Description.

culated for digestion. Some that were purchased by Mr. Collinson, (as his letter inserted in the Phil. Trans. states,) had their bellies hard and prominent, appearing to be filled with rows of some hard substance, which, on being opened, were found to be shell-fish. These, from the bulging of the shells and the intervening interstices, gave the intestines somewhat the appearance of strings of beads. On further examination, some of them were found nearly dissolved, others partly so, but many of them whole. The most usual food of soles is the spawn and young of other fish.

These fish are found on all of the British coasts; but those of the western shores are much superior in size to what are taken in the north, since they are sometimes found of the weight of six or seven pounds. The principal fishery for them is in Torbay.

THE HOLIBUT.

THE holibut, (of which mention has been made in our description of the turbot,) is, in respect to its length, the narrowest of any of this genus except the sole. It is perfectly smooth, and free from spines, either above or below. The color of the upper part is dusky; beneath, of a pure white. It would be useless to count the rays of the fins of this genus, not only because

Voracity of the holibut.

they are so numerous, but because nature has given to each species characters, independent of these rays, sufficient to distinguish them by.

This is the largest of flat fish; some have been taken in our seas weighing from one hundred to three hundred pounds; but much larger are found in Newfoundland, Greenland, and Iceland, where they are taken with a hook and line in very deep water. They are part of the food of the Greenlanders, who cut them into large slips, and dry them in the sun. They are common in the London markets, where they are exposed to sale cut into large pieces. They are very coarse eating, except the part that adheres to the side fins, which is extremely fat and delicious, but surfeiting.

Holibuts are the most voracious of all flat fish; there have been instances of their swallowing the lead weight at the end of a line, with which the seamen were sounding the bottom from on board a ship.

THE PLAISE.

PLAISE are very flat, and much more square than the generality of flat fish. Behind the left eye is a row of six tubercles that reaches to the commencement of the lateral line. The upper part of the body and fins are of a clear brown,

Descriptions.

marked with large bright orange-colored spots; the belly is white.

These fish are very common on most of our coasts, and sometimes taken of the weight of fifteen pounds; but they seldom reach that size, one of eight or nine pounds being reckoned a large fish. The best and largest are taken off Rye on the coast of Sussex and in Ireland; also off the Dutch coasts. They are watery eating, but are, notwithstanding, admired by some. They spawn in the beginning of February.

THE DAB

IS found with the preceding species, but is less common. It is generally of an uniform brown color on the upper side, though sometimes clouded with a darker. The scales are small and rough, which is a character of this species. The lateral line is extremely incurvated in the beginning, then goes quite straight to the tail. The lower part of the body is white.

This fish is in best season during February, March, and April: they spawn in May and June, and become flabby and watery the rest of summer. They are superior in quality to the plaise and flounder, but rather inferior in size.

Time of spawning—When in season.

THE FLOUNDER.

THE color of the upper part of the body of this fish is a pale brown, sometimes marked with a few spots of dirty yellow; the belly is white. It may be easily distinguished from the plaice, or any other fish of this genus, by a row of sharp small spines that surround its upper sides, and are placed just at the juncture of the fins with the body: another row marks the side line, and runs half down the back.

Mr. Pennant mentions his hearing of a flounder that weighed six pounds, but one half that size is not common.

These fish spawn in May and June, and are in season the rest of the year. They swim in shoals, and bite freely at all hours in the day, but particularly on the rise of the waters by flood or tide, and in warm weather, with a little wind, and are to be fished for with a strong line and good girt at the bottom, as some of them are large and struggle much. The best places to angle for them are by the sides and at the tails of steep streams, where the bottom consists of fine gravel sand or loam, or in still places of the same quality near the banks; two or three rods may be used with a bullet on the lines, to lie on the ground in the streams; and when in still water, a shot or two on the line, and the hook small. Brandlings that are taken from rotten tan, well scoured, are the best baits: they will take

Description.

the lob-worm, and even the minnow, a flounder weighing twenty-three ounces having been caught, in 1799, with the latter.

This fish inhabits every part of the British Sea, and is found, although at a great distance, in all the rivers that communicate with it; numbers of them that are not taken lose themselves, continuing and breeding with vast fecundity in the rivers, and those grow to be the largest and best flavored. They will likewise live in ponds, and are a profitable fish to stock them with, as they soon get fat, will live many hours out of their element, and consequently may be carried to a great distance; but they will not breed when confined.

THE LAMPREY,

IS of a lighter color and clumsier make than the eel, which, however, it much resembles in its general appearance; but its mouth has a greater likeness to that of a leech, it being round, and placed rather obliquely below the end of the nose. This fish has also a hole on the top of the head, through which it spouts water like the cetaceous tribe. On each side are seven holes for respiration; and the fins are formed rather by a lengthening out of the skin, than any set of bones or spines for that purpose.

In great esteem with the ancients,

Naturalists distinguish between the lampein and the lamprey; the former they say has a single row of little teeth in the verge of its mouth, besides the lower large ones: it grows to about a foot and a half, though most of those usually caught are under that standard. The latter has about twenty rows of teeth, and grows to two feet and a half, or more, in length.

A species of the lamprey was in great esteem with the ancients. We are told by the Roman writers, that a senator of rank had attained to very great celebrity for his taste in good eating, and the luxury of his table: his fish in particular were distinguished for flavor and feeding. Augustus became his guest, and found that fame had done justice to his merits—his lampreys were indeed of excellent taste. The emperor was desirous to know by what means he gave them so fine a relish: the epicure was happy to instruct the emperor, and told him, “that it was his custom to throw into his pond such of his slaves as had at any time displeased him.” Augustus did not admire the receipt, for he instantly ordered all the man’s ponds to be filled up; and perhaps many of our readers would not be sorry, could we have informed them that the owner had been thrown in with the rest of the rubbish.

The lamprey of the Italians agrees with the ancient fish, in being kept in ponds, and considered by the luxurious as a very great delicacy.

Remarkable preparation for spawning.

Muralto, in his very minute description of the lamprey, makes not any mention of lungs: yet from some peculiarity in its formation, this animal generally swims as near as possible to the surface; and it might be easily drowned by being forcibly kept under water for a considerable time. The absolute necessity it is under of breathing in the air, must convince the attentive observer that it really has lungs; and it is very probable [that the two red glands tissueed with nerves, (described by Muralto as lying towards the back of the head) are no other than the lungs of the animal.

This fish usually leaves the sea the beginning of spring, in order to spawn, and after a stay of a few months, it returns again to the sea. The species known among us is differently estimated according to the season in which it is caught, or the place where it has been fed. The best season for them are the months of March, April, and May; and they are usually taken in nets with salmon, and sometimes in baskets at the bottom of the river. Those that leave the sea to deposit their spawn in fresh waters are the best; those that are entirely bred in our rivers, and that have never been to sea, are considered as much inferior to the former. These fish's preparation for spawning is a remarkable circumstance in their natural history. Previous to their depositing their spawn, they make holes in the gravelly bottom of rivers; and if they meet with a stone

The female's attention to her brood.

of considerable magnitude, their power of suction is particularly serviceable and successively exerted in removing and throwing it out. Like other flat fish, the lampreys are produced from eggs, but are not, like most others, left to chance for their maturation, for the female remains near the place where they are excluded. One single brood is the extent of the female's fertility; and she, according to Rondolelius, may be frequently seen playing about them, and after some time she conducts them in triumph back to the ocean, at least such as have sufficient strength for that purpose; the remainder continue in the fresh water until they die, or are caught; but their flavor never equals that of such of them as have undergone a sea voyage. Those lampreys which are caught after they have cast their spawn, are found to be flabby, and of little value, and particularly so at the approach of hot weather. In many parts of Ireland the people will not venture to touch them. Those caught in the English Severn are considered as the most delicate of all other fish whatever; and it has been an old custom for the city of Gloucester to present the king annually with a lamprey pie; and as the gift is made at Christmas, the difficulty of procuring a sufficient quantity is so very great, that the corporation have sometimes been obliged to purchase them at a guinea a piece.

This fish was in high demand among our forefathers: so late as the reign of Henry V. we find

Peculiar power of adhesion.

that a specific power was granted to two persons to buy, take, and provide all the live lampreys they could, in or out of the Seine, between Rouen and Harfleur: and to two others, the like power between Lislebon and Harfleur; so that it should seem Henry V. was not afraid of the ill effects of eating this fish, which cost Henry I. his life.

The lamprey is remarkable for its peculiar adhesion; for as its mouth is formed very much resembling that of the leech, so, like that creature, it has the property of sticking close to, and sucking any body it is applied to. Such is its extraordinary power in adhering to stones, that it is said one which weighed but three pounds stuck so firmly to a stone of twelve pounds, that it remained suspended at its mouth, from which it was separated with difficulty.

This wonderful power of suction in the animal, is ascribed to its exhausting the air within its body by the hole over the nose, while the mouth is closely fixed to the object, and permitting no air to enter. If this be really the cause, the weight which the fish will be able to sustain may pretty accurately be determined; for it will be equal to the weight of a column of air of the same diameter as the mouth of the fish. This power of adhesion may probably be somewhat increased by that slimy substance with which its body is all over smeared, like the eel; a substance that serves equally to preserve its skin soft and

Short duration of the lamprey's life.

pliant, as to keep it in a proper degree of warmth in the watery element. Two lymphatic glands, extending on each side from the head to the tail, serve to separate this mucus, and furnish it in great abundance.

The lamprey has no other intestines than one great bowel, running from the mouth to the vent, wide in the middle, but narrow at both ends. The simplicity of its appetite perfectly corresponds with the simplicity of its conformation; for its food seems to be either slime and water, or such small insects as are scarcely visible. When it comes into our rivers, it is hardly perceived to eat any thing; though in its native element, the sea, perhaps its appetite may be more active.

The existence of the lamprey is of very short duration: after casting her eggs, she becomes flabby and exhausted, appears prematurely old, and two years generally puts a termination to her natural life.

THE MACKREL, OR MACKAREL.

THE common mackrel has a thick, round, fleshy body, but tapering towards the tail, which is bifurcated. Its body is of a very elegant form, and beautifully variegated with the brightest hues of blue, green, and a silvery whiteness. Death in some measure impairs the colors, but it by

Several varieties, and various sizes.

no means obliterates them. Several varieties of this fish inhabit the ocean: they belong to the voracious class, and some of them grow to a very great size. As they are found in the German ocean, the Baltic and Mediterranean, it is not surprising that the ancient naturalists were acquainted with them. Aristotle mentions six, and Pliny seven kinds. Subsequent naturalists have reckoned upwards of thirty, but of these varieties only three are found upon our coasts: these are the common mackrel, the bastard or horse-mackrel, and the thunny.

The mackrel of the Baltic and Mediterranean seas are smaller than those of the German ocean, seldom exceeding a foot in length, and weighing about a pound. In the latter they sometimes measure two feet, and Pennant mentions an instance of one taken on the English coast that weighed five pounds. In general they seldom exceed two pounds.

The mackrel is also found round the Canary islands, at Surinam and St. Croix in the West Indies, and in many other parts of the ocean. It is one of those gregarious fish that appear in immense shoals at regular periods, and it is at the same time one of the most delicate and useful of those that visit our coasts. It is, however, so very tender, as to be unfit for long carriage. In winter they keep themselves concealed in the depths of the sea, and in spring repair to the shores either to breed or in quest of food, which

Pursues herrings—Emits a phosphoric light.

is more easily obtained there than in the ocean. Anderson and several others assert, that in winter it inhabits the Northern ocean, and that in spring, like the herring, it passes the coasts of Iceland, Scotland, and Ireland, where the shoal divides into two bodies, one of which repairs to the Spanish seas, and the other to the coasts of Holland and the Baltic. In this case the mackrel would have to make a longer voyage than the herring; for it is found even in Egypt, Japan, at Surinam, and about all the islands of North and South America.

To some nations the mackrel fishery is an object of considerable importance. In June and August the Dutch markets abound with this fish, and during the whole summer it is extremely plentiful in those of England, but particularly in the month of June, which is the time of spawning. As the mackrel is fat and soon spoils, it is the only fish permitted to be sold publicly in this country on Sundays. In Norway, it appears in vast quantities in the spring, to the no small mortification of the fishermen, as it pursues the herrings with the utmost avidity, and frequently frightens them away: indeed, their voracity has scarcely any bounds.

This fish emits a phosphoric light when fresh from the sea; it soon dies when taken out of the water, and even in the water, if it advance with too much impetuosity against the net. It is caught with that instrument, or with a hook

Modes of fishing for mackrel.

baited with small herrings and pieces of other kinds of fish or flesh. In some places it is taken by lines from boats, as during a fresh gale of wind it readily seizes a bait. It is necessary that the boat should be in motion in order to drag the bait along (a bit of red cloth, or a piece of the tail of a mackrel,) near the surface of the water. The great fishery for mackrel is on some parts of the west coast of England. This is of such an extent, as to employ in the whole a capital of near 200,000*l*. The fishermen go out to the distance of several leagues from the shore, and stretch their nets, which are sometimes several miles in extent, across the tide, during the night. The meshes of these nets are just large enough to admit the heads of tolerably large fish, and catch them by the gills. A single boat has been known to bring in after one night's fishing, a cargo that has sold for near seventy pounds.

Besides these, there is another mode of fishing for mackrel in the west of England, with a ground seine. A roll of rope of about two hundred fathoms in length, with the net fastened to the end, is tied at the other to a post or rock on the shore. The boat is then rowed to the extremity of this coil, when a pole fixed there, leaded heavily at the bottom, is thrown overboard. The rowers from hence make as nearly as possible a semi-circle, two men now continually and regularly putting the net into the water. When they come to the other end of the net, where there is

Said to be fond of human flesh.

another leaded pole, they throw that overboard. Another coil of rope, similar to the first, is by degrees thrown into the water, as the boatmen make for the shore. The boat's crew now land, and with the assistance of persons stationed there, haul in each end of the net till they come to the two poles. The boat is then again pushed off towards the centre of the net, in order to prevent the more vigorous fish from leaping over the corks. By these means three or four hundred fish are often caught at one haul.

These fish are said to be fond of human flesh. Pontoppidan relates that a sailor, belonging to a ship lying in one of the harbors on the coast of Norway, went into the water to wash himself, when he was suddenly missed by his companions. In the course of a few minutes, however, he was seen on the surface with vast numbers of mackrel fastened on him. The people went in a boat to his assistance; and though, when they got him up, they forced with some difficulty the fish from him, they found it was too late, for the poor fellow very shortly afterwards expired.

Mackrel deposit their spawn among the rocks near the shore; their fecundity is truly surprising. Bloch says, that in the month of June the roe of a mackrel weighing one pound and two ounces, contained five hundred forty-six thousand, six hundred and eighty-one eggs.

In spring their eyes are covered with a white film, that grows in the winter, and is regularly

Good eating—How preserved.

cast at the beginning of summer. During this time they are said to be nearly blind.

The mackrel is very good eating; but as it is fat, and consequently difficult of digestion, it is not fit for weakly persons or valetudinarians. In Italy it is preserved by pickling, and in Norway and England by salting. In this country it is salted in two ways: after the intestines are taken out, the vacancy is filled with salt, and the fish are then packed in casks with a layer of salt and a layer of fish alternately; or they are immersed in brine, and left till sufficiently impregnated with it, when they are packed in barrels, in the manner already described. A passage in Columella and Pliny prove that this method of preserving mackrel is of great antiquity, and was known to the Romans. In Scotland they are prepared like herrings, and for this purpose the largest and best fish are selected. It was with this fish that the Romans composed their celebrated pickle, called *garum*. That from Carthage was held in particular estimation, and Strabo asserts that great numbers of mackrel were caught at that place. According to Pliny this *garum* was a very important article of commerce in that country, being not only an excellent sauce, but likewise employed in medicine in diseases of the liver and other complaints.

In the Mediterranean the roes of this fish are used for cavier: the blood and slime are first washed off with vinegar, and the sinews and

Similar to the common mackrel.

skinny part taken away. They are then spread out for a short time to dry, and afterwards salted and hung up in a net, to drain some of the remaining moisture from them. When this is finished, they are laid in a kind of seive till thoroughly dry and fit for use.

THE BASTARD, or HORSE MACKREL,

LIKEWISE denominated the scad by Pennant, very much resembles in form the common mackrel. On the side it has sixty-eight *scuta*, or bony plates, placed one over the other like the tiles on the roof of a house, and each of which is armed with a sharp point curved towards the tail. The upper part of the eye is covered with a film or cuticle.

This fish is not more than seven or eight inches long near Kiel, on the coast of Holstein; but on our shores its usual length is a foot, and two feet in the Mediterranean. It was not known to the ancient naturalists, or not distinguished by them.

The horse mackrel is a voracious fish. Willoughby found the small fish called the launce in its stomach. Like the common mackrel it is gregarious, and appears in shoals in the spring upon the sea coasts. As it spawns at the same time, it is sometimes caught with the mackrel, both by net and line. The flesh of this fish is

Description.

not so tender nor so fat as that of the preceding sort, and is said to be difficult of digestion. However, at Kiel, where it is caught in the spring, it is considered a dainty dish. In Italy it is held in no estimation. It is usually salted in the same manner as the herring.

THE THUNNY.

THE body of this fish is round, thick, and fleshy, but at the head and tail it tapers nearly to a point. The skin of the back is very thick and black, and that of the sides and belly silvery, tinged with light blue and pale purple. The tail is crescent-shaped, with the tips far asunder; and the spurious fins between the dorsal fin and the tail, (which mark the species,) are from eight to eleven in number. This was a fish so well known to the ancients, as to form one of the greatest articles of their commerce. It was highly esteemed by the Romans. At present it is found in the German ocean and the Mediterranean, and on the coasts of Guinea, Brasil, the West India islands, Chili, and China. Its ordinary length is two feet; but sometimes it attains a monstrous size. On the Guinea shore it is found of the length and size of a man; those caught on the coast of Brasil are frequently seven feet long. Pennant describes one of seven feet ten inches, which was five feet seven inches in circum-

ference, and weighed four hundred and sixty pounds. Schoneveld mentions another taken on the coast of Holstein eight feet and a half long. Aristotle speaks of a thunny that weighed fifteen talents, equal to six hundred and fifty-two of our pounds; and Cetti asserts that it is not rare to catch them of one thousand or even eighteen hundred pounds. The former erroneously asserts that this fish grows so fast, that its daily increase in magnitude is perceptible to the eye: he is also mistaken in fixing the duration of its life at two years. This fish is probably the largest inhabitant of the deep that is used as food by man. Its extraordinary magnitude has caused some writers to consider it as a species of whale.

The thunny, according to Rechler, was, among the ancients, an emblem of conjugal fidelity, and usually formed a part of repast at the celebration of a wedding. The Greeks consecrated it to Diana.

The male of this species is thought to attain a greater size than the female, as M. Cetti assures us that soft roes are always found in the largest taken on the coast of Sardinia. Their ordinary food is herrings; but they likewise pursue mackerel, and watch for the herrings that escape from the nets of the fishermen. Their greatest enemy is the shark.

Aristotle and Pliny tell us, that the thunny, in the dog-days, is tormented by an insect of the size of a spider, and the figure of a scorpion,

Tormented by an insect--Voyages.

which fastens itself underneath the fins of the belly. When stung by this insect the thunny becomes furious, and, as Oppian asserts, leaps upon vessels and upon the shore. The skin of the thunny under the fins of the belly is extremely soft, which is the reason assigned for the insect fixing upon it in preference to other fish.

These fish, according to the vulgar notion, go from the North Sea to the Mediterranean, but Cetti declares that great numbers are found in winter in the sea of Sardinia. They enter the Mediterranean about the vernal equinox, travelling in a triangular phalanx, so as to cut the waters with their points, and to present an extensive base for the tides and currents to act against and impel forwards.

They repair to the warm seas of Greece to spawn, steering their course thither in shoals of several hundreds along the European shores; and though these fish are so large, their ova do not exceed in size a grain of millet. They spawn in depths of about one hundred feet, avoiding the shores where the sea is not so deep. On their return they approach the African coast: the young fry is placed in the van of the squadron as they travel. They come back from the east in May, and abound about that time on the coasts of Sicily and Calabria. In autumn they steer northward, and frequent the neighbourhood of Amalphi and Naples. During these voyages

they make a great noise ; and, according to Plutarch, go close together in regular rows like herrings ; which explains what Pliny says concerning the fleet of Alexander the Great. “ The vessels being unable to pass through such an army of fish, which could not be dispersed by any noise, however great, they were obliged to form in order of battle, and to advance against them as against an enemy.”

There are considerable thunny fisheries in various parts of the Mediterranean, where they are caught with a large net in the form of a sack, called in Italy tonnaro. The principal person in this fishery is called rais, or grand commandant, who must be perfectly acquainted with every circumstance relative to the capture of the thunny. According to a pre-concerted plan, an immense edifice is formed with a net extended in the open sea, with such solidity, that amidst the most violent tempest it remains immoveable as a rock. It is about the beginning of the month of April that the fishermen prepare these tonnaros. They form a kind of maritime fortress, which they erect at a great expence, with large nets, and fix to the bottom of the sea with anchors and leaden weights. Some idea may be formed of a tonnaro, from the following account given by M. Cetti, who says, that in a light boat with ten oars, it took him three quarters of an hour to go from one extremity to the other. These tonnaros are always constructed in the

Thunny fishery in parts of the Mediterranean;

streights between rocks and islands, to which places the thunnies resort in the greatest numbers. The entrance of these passages is carefully closed with nets, excepting a small aperture called the outer door of the tonnaro. This door leads to the first chamber, or the hall, as it is denominated. As soon as the fish have gone into the hall, the fishermen, watching for them, close the outer door by dropping a small piece of a net, which prevents their escape. They then open the inner door of the hall, which leads to the second apartment, called the antichamber. To drive them into this chamber the following artifice is employed; the fishermen take a handful of gravel, which they throw at the fish, and this they repeat till all the thunnies are in the division called the antichamber. The thunny is so timid, that when he feels the gravel he is frightened, and takes refuge in the antichamber. Sometimes, however, the gravel is not sufficient; therefore, to effect this purpose, they let down into the sea a frightful figure made of a sheepskin. Should this expedient be found unavailing, the chamber is closed with a strong net, and the fish are driven in by force. When they are all in the antichamber, the inner door is likewise closed, and the outer one is opened, for the admission of another company. Some of these tonnaros are composed of a great number of chambers, each having a particular name; but the last of them is always denominated the

chamber of the dead, and is composed of stronger nets and anchors than the others. When a sufficient quantity of thunnies is collected, they are all made to pass through the other chambers into that of the dead, where the battle commences. The fishermen, and sometimes people of distinction, armed with a pike, there attack these defenceless animals. Driven to despair the latter become furious, throw up the water, break the nets, and frequently dash out their brains against the rocks, or the boats of their adversaries.

The thunny is to the people on the coasts of the Mediterranean, what the herring is to the nations of the north. The number of those that enter that sea by the streights of Gibraltar, is computed at four hundred thousand. Immense quantities likewise enter by the Dardanelles from the Black sea. Within the last thirty years the thunny fishery has become an important national object to Sardinia, about forty-five thousand being caught annually upon an average. All these are taken by means of a dozen tonnaros. Jageman, in his "Letters on Italy," relates, that at Porto Louis alone, the yearly produce of the thunny fishery is twenty thousand Italian crowns.

Even in the time of the Greeks and Romans the thunny fishery was carried on to a great extent at the Cape of Byzantium, as we learn from Aristotle, Ælian, Strabo, and Pliny. With the decline of the arts and sciences this fishery

Timid, though formidable in appearance.

also declined. The Spaniards, who formerly applied themselves with much assiduity to fishing, likewise monopolized the thunny fishery. According to some writers, this fish was formerly so esteemed for the advantages of commerce which it procured, that the coins of Spain and Italy bore its impression. On the Spanish coast were maintained seventeen tonnaros, the most celebrated of which was that near Conil. In one single day, however, that kingdom lost the rich thunny fishery, which passed into the hands of other nations. This was the memorable day on which the city of Lisbon was destroyed by an earthquake; whereby a great quantity of sand, and other marine substances, was detached from the African coasts and lodged on those of Europe; so that the sea on the Spanish shores became considerably shallower, while the harbors of Tetuan and Sale in Barbary were emptied out and perfectly cleansed. The ensuing spring, when the thunnies passed from the ocean into the Mediterranean, they found the Spanish shores almost choaked up with sand; they therefore kept at such a distance from the coast, that it would have required nets of an immense length to catch them. The Thunny fishery was then transferred to Naples and Sardinia.

Though this fish appear formidable from its monstrous bulk, yet it is so timid, that when once caught it gives the fishermen very little trouble: for when it perceives the first efforts

Eaten both fresh and pickled.

ineffectual, it submits to its fate without resistance, and remains quietly in the net. It is eaten both fresh and pickled. To salt it the fishermen hang it up by the tail, cut it open, and after taking out the entrails, and separating the flesh from the spine of the back, they cut it in pieces and put it into brine. Great quantities thus prepared are sent to Constantinople. This trade was formerly much more considerable than at present, the herrings of Holland and England, the caviar of Russia, and the anchovies of France, being now substituted for the thunny. It was particularly esteemed in Italy, where different names were given to the different parts of the fish. The small lean pieces cut lengthwise were denominated tarentalla, and the fat pieces from the belly, ventresca and sorra.

The thunny frequents the English coast, but not in such numbers as are found in the Mediterranean. It is frequently met with in the lochs of Scotland, where they come in pursuit of the herrings, and often during the night strike into the nets, and do considerable damage. When the fishermen draw these up in the morning, the thunny rises at the same time towards the surface, ready to catch the fish that drop out. On its being observed, a line is thrown into the water, having a strong hook baited with a herring, which it seldom fails to seize.

The quantity of these fish that is annually consumed in the two Sicilies almost exceeds the

The flesh of the thunny varies in every place.

bounds of calculation. Its flesh varies incredibly, differing almost in every place and in every depth; sometimes it is firm and sometimes flabby; in some places it resembles veal, and in others pork. When taken in May they are full of spawn, and are then esteemed unwholesome, as being apt to occasion headaches and vapors: to prevent in some measure these bad effects, the natives fry them in oil, and afterwards salt them. The pieces, when fresh, appear exactly like raw beef; but when boiled they turn pale, and have somewhat the flavor of salmon. The most delicate parts are those about the muzzle. What the inhabitants are not able to use immediately are cut into slices, salted, and preserved in large tubs, either for sale or winter provisions.

PERCH.

THE body of this fish, which was highly esteemed by the Romans, and still admired as firm and delicate, is deep, the scales very rough, the back much arched, and the side line approaches near to it; the irides are golden, the teeth small, disposed in the jaws and on the roof of the mouth, which is large; the edges of the covers of the gills serrated, on the lower end of the largest in a sharp spine; and the head is said to consist of no fewer than eighty bones. The colors of the perch are beautiful, the back and

Extreme voracity—Usual weight—Haunts.

part of the sides being of a deep green, marked with broad black bars pointing downwards; the belly is white, tinged with red; the ventral fins of a rich scarlet, and the anal fins and tail (which is a little forked) of the same color, but rather paler.

Perch are gregarious; and, contrary to the nature of nearly all fresh water fish that swim in shoals, they are so voracious as to attack and devour even their own species. They grow slowly, and are seldom caught of extraordinary size. The largest that was ever heard of in this country was caught some years ago in the Serpentine river in Hyde Park; it weighed nine pounds. Another was taken in Dagenham Breach, which weighed eight pounds. The usual weight is not, however, more than from half a pound to two pounds; and their general length is from about ten to sixteen inches, which is considered large. At Malham Water, not far from Settle in Yorkshire, the perch grow to five pounds weight and upwards; and this remarkable circumstance attends them, that the large fish are all blind of one or both eyes.

Perch are found in clear swift rivers with pebbly or gravelly bottoms, and in those of a sandy or clayey soil. They seem to prefer moderately deep water, and holes by the sides of or near to gentle streams, where there is an eddy; the hollows under banks, among weeds, and roots of trees; the piles of bridges, or ditches and back

Great diversion for the angler.

streams that have a communication with some river. They will also thrive fast in ponds that are fed by a brook or rivulet. They are exceedingly tenacious of life, having been known to survive a journey of near sixty miles, although packed in dry straw. They live chiefly upon the smaller fish, but are in their turn the prey of the pike, but more of eels, and likewise of ducks. It is, however, generally believed that the pike will not attack a full grown perch, on account of the spiny fins on its back, which this fish always erects on the approach of an enemy. The smaller perch, however, have been frequently used with success, (as the Rev. Mr. Daniel remarks,) as bait for the pike.

Perch spawn, according to many opinions, in February or March, but certainly in April or May. They are said usually to deposit their spawn, sometimes to the amount of two hundred and eighty thousand ova, while rubbing themselves against some sharp body.

The perch affords the angler great diversion, the season for which is from April to January; and the time from sunrise till ten o'clock, and from two o'clock till sunset; except in cloudy weather, with a ruffling south wind, when they will bite all day. The baits are various kinds of worms, a minnow, or grasshopper. So voracious are these fish, that, it is said, if an expert angler find a shoal of them, he is sure of taking every one. If, however, a single fish escape that has

A singular deformed variety.

felt the hook, all is over; this fish becomes so restless as soon to occasion the whole shoal to leave the place.

In winter the perch is exceedingly abstemious, and during that season scarcely ever bites, except in the middle of a warm, sun-shiny day. In clear weather in the spring, sometimes a dozen or more of these fish may be observed in a deep hole, sheltered by trees and bushes. The angler may then observe them striving which shall first seize his bait, till the whole shoal are caught.

In a lake called Llyn Raithlyn, in Merionethshire, there is a singular variety of the perch, the back of which is hunched, and the lower part of the back-bone next the tail is strangely distorted. It is remarked by the Hon. Daines Barrington, (according to some specimens which he had received,) that they were not only crooked near the tail, but for about one third of the whole length of their body; and had likewise a very remarkable protuberance on each side, which he had opened with a knife, but it did not materially differ from other parts of the flesh, and when dressed, there was nothing in the taste to distinguish them from the common kind, which are as numerous in this pool as the deformed fish. Some of the crooked perch have likewise been found in the small Alpine lakes of Sweden.

Description—Numerous in the northern latitudes.

THE HERRING.

THE common herring is distinguished from the other fish of the same tribe, by the projection of the lower jaw, which is curved, and by having seventeen rays in the vent fin. The head and mouth are small, the tongue short, pointed, and armed with teeth; the covers of the gills generally have a violet or red spot, that disappears soon after the death of the fish, which survives a very short time when taken out of its natural element; hence the adage in common use, "as dead as a herring." These fish vary greatly in their size. Pennant says, he was informed that there is sometimes taken near Yarmouth a herring distinguished by a black spot above the nose, which had been seen of the great length of twenty-one inches and a half.

Herrings are found in the greatest abundance in the highest northern latitudes. In those inaccessible seas that are covered with ice for a great part of the year, they find a quiet and sure retreat from all their numerous enemies. The quantity of insects which those seas supply is immensely great. Thus remotely situated, and defended by the icy rigor of the climate, they live at ease, and multiply continually, coming out from thence in innumerable shoals, partly in spring and partly in autumn, to the surface of the water, and proceeding to the mouths of the rivers for the purpose of spawning and

Astonishing fecundity—When first pickled.

seeking their food there. Their enemies are, however, numerous, which seems to be the happy contrivance of providence to keep them within bounds, for their fecundity is astonishing: it has been calculated, that if the offspring of a single herring could be suffered to multiply unmolested and undiminished for twenty years, they would exhibit a bulk of ten times the size of the earth.

This fish, which is in such general use, being seen both at the table of the rich and in the cottage of the poor, was known to our ancestors at a remote period. They, however, did not derive from it that advantage which succeeding ages have been enabled to do. It did not then, as at the present day, form a considerable branch of commerce; the method of preserving it from corruption, by means of sea salt, being then unknown. Towards the close of the fourteenth century, that secret was accidentally discovered by William Beuckel, of Biervliet, near Sluys, in Holland, and from his name is derived the term *pickle*, which we have borrowed from the Dutch. Beuckel died in 1397, and a hundred and fifty years afterwards, the emperor Charles the Fifth, to shew his regard for this benefactor of mankind, celebrated the invention by eating a herring on his tomb.

It is generally believed, that in winter the herrings retire to the Arctic, or Icy ocean, and that they depart from hence on their migrations to the southern parts of Europe, and to America.

Supposed causes of their migrations.

The more immediate cause of migration is variously accounted for. Leuwenhoeck says, that the Channel every year teems with an innumerable quantity of worms and little fish, on which the herrings feed; that they are a kind of manna, which these fish come punctually to gather up; and when they have entirely cleared the seas in the northern parts of Europe, they descend towards the south, where they are invited by a new stock of provisions. Anderson is of opinion, that they would never depart from their most desirable retreat in their icy, northern entrenchments, did not their numbers render it necessary for them to migrate; and as with bees from a hive, they are compelled to seek for other retreats.

Another opinion is, that they remove for the sake of depositing their spawn in warmer seas, that will mature and vivify it more assuredly than those of the frozen zone.

Respecting the manner of migration, a celebrated naturalist says, "the herrings being frightened by the numerous enemies which pursue them, retire to the Arctic ocean, where those enemies cannot live beneath the ice for want of air. But as they multiply prodigiously in that sea, they are obliged, by the scarcity of food, to send off colonies at the beginning of every year. These colonies, after clearing the ice, extend in a vast body some hundred miles in breadth; but meeting with numerous enemies by the way, they are attacked, dispersed, and separate into

Manner of its migration.

two divisions: that to the right sheering off to the west, the left proceeding eastward. The former pressing close to each other, seek an asylum on the coasts of Iceland, where they arrive about the month of March; then turning westward, they arrive at the great bank of Newfoundland, after which it is not ascertained what becomes of them. The other division proceeds southward, and forms two columns, one of which descends along the Norwegian coasts, through the Sound and Belt into the Baltic; the other steers westward to the Orkney and Shetland islands. The latter column is again divided into two brigades; one portion turning towards Ireland and Scotland, then making the circuit of Ireland, enters the Atlantic, passes through the Channel, and arrives on the coasts of the Netherlands. The other part, following the east coasts of Scotland and England, passes into the north sea, where the two columns unite. At length, after these vast shoals have fed the inhabitants of all the coasts bordering on the Baltic and the German ocean, the remainder assemble in the latter and again disappear. At last, as no traces of them are afterwards found on the European coasts, it is presumed that they return to their native deeps."

Bloch, however, ventures to call in question the accuracy of this hypothesis, though ingenious, and generally adopted. "The herring," he asserts, "never, or at least very rarely, appears

Bloch's observations.

on the coasts of Iceland; it is caught all the year round in the countries bordering on the Baltic sea and German ocean." He likewise says, "that it is impossible for the fish to make a circuit of several thousands of miles in such a short space of time;" and asks, "why, if the herrings were frightened from the Arctic ocean by the whales, they should go many hundreds of miles after the danger has ceased; why they should return, and expose themselves again to the persecutions of their formidable enemy; and how it happens that we can discover no traces of their return? But," adds this author, "all these difficulties vanish, if we attentively observe nature in all her operations. In common with other fish, the herrings leave their usual abode in the spawning season, and repair to places that are more convenient for the purpose. Like them they quit the smooth bottom of the ocean to seek spots rendered rugged and uneven by the actions of the currents, in order there to deposit their spawn. When the season approaches, it is this instinct, and not the dread of the whales, that impels them to seek those places. They spawn in different bodies at three different times, and usually according to their age. Besides this, as the season of spawning happens later or earlier, according to the temperature of the water and the air, it is easy to account for the appearance of the herring at different times. For example, in the Baltic and on the Norwegian

Empty, virgin, and full herrings.

coasts, there appears in the spring a small kind of herring that has just spawned; in summer a larger kind succeeds, which in autumn is followed by a smaller species which is just ready to spawn. Therefore these three kinds are denominated by the Dutch dealers, empty herrings, virgin herrings, and full herrings. The first are such as have spawned in the spring, the last spawn in autumn and winter, whereas the virgin herrings spawn in summer. It is ascertained that the fish of seas and lakes, which pass in spring into the rivers, do not return till autumn to their usual place of abode. The same is doubtless the case with herrings, and this is the cause of their dispersion in winter. It is likewise possible that the herring, which is a small sea fish, spawns more than once a year, like several small river fish. Nature employs different means for attaining the same end: thus, as the small fish often become the prey of the larger kinds, it is necessary that the former should multiply much faster than the latter; and this end is answered by their more frequent reproduction. The same observation has been made respecting small birds, and several other species of animals. This prodigious multiplication has induced some writers to imagine that this fish breeds beneath the ice of the Arctic ocean; but when we reflect on the immense space assigned to the herring for its abode, we shall not be surprised at the prodigious quantity of these animals, and their extraordinary

multiplication, which makes good the immense quantities that are daily consumed."

Indeed it appears from one circumstance, that these creatures are governed by a choice in respect of the shores they pitch upon; or that having fixed upon a shore, they will frequent it for several seasons, or indeed for several ages, and then most capriciously forsake it. For some ages the shores of Norway were the resort for herrings, as the banks of Newfoundland are for cod, and thousands of European ships resorted thither; but some short time previous to the year 1600, they forsook the Norwegian coasts, and made the shores of Germany their annual resort, where the Hanse towns derived much advantage from their capture and sale. For above a century, however, their greatest colonies have visited the British Channel and the Irish shores, though for their apparently capricious desertion it will not be easy to assign a cause. This we may observe, that from the earliest accounts of time, the blessing of their annual visitation has never been withdrawn from the whole, though it may have been denied to particulars.

The shoals of herrings proceed in regular order like the salmon; two or three days after spawning they return to the open sea, making a noise like a violent shower of rain. No fish is exposed to greater persecution than the herring; man in particular maintains a continual war against it, not only on the coasts, but even send-

Exposed to persecution—Principal food.

ing whole fleets in quest of them into the open sea. A species of the whale destroys them by thousands. The birds likewise dart upon numbers of them when near the surface of the water; and indicate to the fisherman those places where he may throw out his nets with a prospect of success.

The herring, however, which is so frequently exposed to the voracity of other animals, belongs itself to the class of voracious fish. Its principal food consists of small crabs. Neucrantz found in its stomach several that were but half digested. The herring is likewise fond of worms, and the Norwegian fishermen frequently find its stomach full of small lobsters. When this is the case, the fish is commonly thought to have some disease, in consequence of the tendency to spoil before it is salted. The method to prevent this accident, is to leave the fish in water for some time, till the food in the stomach be entirely digested. They are likewise supposed to feed on a crustaceous sea insect called *oniseus marinus*; and, as they may be caught with an artificial fly, it appears that they sometimes seize winged insects.

This fish may be removed into waters which it has not been accustomed to frequent, as has been successfully tried in Sweden. The removal of the spawn alone is sufficient to produce this effect, as may be seen by a passage in Kalm's Travels. "Franklin," says that author, "related

Franklin's successful experiment.

to me the following fact. In that part of New England where his father lived, two rivers discharge themselves into the sea; in one of these were caught great quantities of herrings, while none were observed in the other, though their mouths were at a very small distance. It was remarked on the contrary, that the herrings annually ascended the former to deposit their spawn. Franklin, who lived between the two rivers, tried whether it were not possible to make the herrings ascend the other river likewise. With this view he took the nets to which the spawn of the fish adhered, and put it into the other river, where it produced young fry. The experiment was attended with the desired success, and afterwards herrings were every year caught in that river. This circumstance induces us to believe that fish are fond of returning to their native place, or such situations as they visit the first time upon leaving the sea, for the purpose of spawning."

Such is the ancient date of the commerce in herrings, that, according to Madox, in 1195, the town of Dunwich was obliged to deliver twenty-four thousand herrings to the king. In the thirteenth century the Icelanders carried on a great trade with this fish, and obtained a grant of the King of England, for themselves and the Hollanders, securing to them the privilege of fishing on the coast near Yarmouth. By a decree of Eric VI. King of Denmark, we find that a com-

A great trade formerly carried on with this fish.

merce in herrings was likewise established in the Baltic about the same period. This decree granted to the Hamburgers a certain district in the island of Schonen, where they might remain during the herring fishery, and erect booths at the time of the fair. In the fourteenth century a fair for herrings was established at Yarmouth; Edward III. in 1357, ordered that the fishermen should sell their herrings only in that town. The Dutch, who had before purchased the herrings on the coasts, of Scotch fishermen, and supplied other nations with them, were in consequence obliged to send out vessels themselves to the fishery. In the same century, we are told by Maizieres, the trade in herrings was very considerable on the Norwegian coast. He says, that in this country above three thousand men assembled in the months of September and October to fish for herrings: this is still one of the principal branches of national industry, and brings into that kingdom annually several tons of gold. Deal, of which wood the Norwegians make their casks, communicates to the herrings a taste that is not generally liked, but of which the Poles are extremely fond. A few years since, the Danish government ordered that the casks used for herrings should be made of oak; but a great decrease was soon observed to take place in the quantity sold. The Poles found that the herrings wanted the usual flavor, and the Danish government was obliged to annul its command.

Dutch fishery.

A commerce still more considerable is carried on by the Dutch with this fish: Mr. Carleson asserts, that it is a gold mine to that nation; and it is a fact, that the Dutch receive more money for this article, than Spain from her mines of Peru and Mexico. At first, as we have already seen, the Dutch purchased herrings of the Scotch fishermen. Their industry, and the judicious regulations that were adopted, soon gave their herrings a decided preference, not only to the Scotch, but even to those of Flanders, which were celebrated for their excellent quality. Their fishery at present is not, however, so extensive as formerly. In 1416, the first large net was made at Hoorn, and from that period the Dutch have sent out busses to the fishery. In 1552, the town of Enckhuysen alone employed one hundred and forty vessels in fishing for herrings; and in 1601, the whole republic sent out one thousand five hundred busses for the same purpose. Since that time the commerce has declined. In 1736, only two hundred and nineteen busses and thirty-one yachts were employed; and in 1773, the Dutch sent out no more than one hundred and sixty-nine busses. The fishery would have declined still more, had not the states of Holland, in 1775, proposed a premium of five hundred florins for each buss that went out to fish for herrings. Notwithstanding its decrease, this fishery still continues

Importance of herring oil to Sweden.

a considerable branch of industry, and affords a subsistence to ten thousand men.

Within these last fifty years, the Swedes, who formerly procured their herrings from other nations, have paid more attention to the fishery and commerce with that fish. In 1745, a company was established for this fishery, which was encouraged by government, and has brought its herrings into great repute, particularly those of Gottenburg. In 1764, that town sent to Hamburg twenty vessels laden with herrings, which were thought equal in quality to those of Holland. From that place alone were exported in 1782, two hundred thousand tons of herrings, and from twenty to twenty-two thousand tons of oil. To make one ton of oil, from twenty to twenty-three tons of herrings are required; and some estimate may be formed of the importance to Sweden of herring oil, since between the years 1760 and 1764, the value of the oil made in that country exceeded two millions of crowns.

The Danes export to Germany, not only the herrings which they take in spring and autumn on the northern coasts of Jutland and the island of Ferro, but likewise send vessels to the coasts of Scotland. In 1767, a herring company was established at Altona, which at present employs fifty busses. A great quantity of smoked herrings is also sent from Holstein to Hamburg, and other neighbouring towns.

Occasional quantities of herrings.

A company for the herring fishery was, in 1770, formed at Berlin; in 1776, busses were sent from Embden to the coast of Scotland; their number has been increased from year to year, so that fifty busses annually left that port before the present war.

The trade in herrings is very great in England and Scotland, and the value of those exported from Glasgow alone, is computed at twenty thousand pounds.

In the year 1773, the herrings were in such immense shoals on the Scotch coasts for two months, that it appears from tolerably accurate computations, no less than 1650 boat-loads were taken in Loch Terridon every night. These would amount to nearly 20,000 barrels.

The herrings likewise once swarmed so greatly on the west side of the isle of Skye, that the numbers caught were more than could possibly be carried away. After the boats were all loaded, and the country round was served, the neighbouring farmers made them up into composts, and manured their ground with them in the ensuing season. This shoal continued to frequent the coast for many years, but not always in numbers equal to these.

About forty years ago, the herrings came into Loch Urn in such amazing quantities, that from the narrows to the very head, about two miles, it was quite full. So many of them were pushed

British herring fisheries.

on shore, that the beach for four miles round the head was covered with them, from six to eighteen inches deep: and the ground under water, as far as could be seen when the tide was out, was equally so. So thick and so forcible was the shoal, as to carry before it every other kind of fish; even ground-fish, skate, flounder, &c. were driven on the shore with the first of the herrings, and perished there.

The principal of the British herring fisheries are off the Scotch and Norfolk coasts; and in our seas the fishing is always carried on by nets stretched in the water, one side of which is kept from sinking, by means of buoys fixed to them at proper distances; and, as the weight of the net makes the side sink to which no buoys are fixed, it is suffered to hang in a perpendicular position like a screen; and the fish, when they endeavour to pass through it, are entangled in its meshes, from which they cannot disengage themselves. There they remain till the net is hauled in, and they are shaken or picked out. The nets are never stretched to catch herrings but during the night, for in the dark they are to be taken in much the greatest abundance. When the night is dark, and the surface of the water considerably ruffled by the wind, the fishermen always assure themselves of the greatest success. Nets stretched in the day-time are supposed to frighten the fish away. In order to strengthen the nets, and render the threads more compact,

How preserved by the Scotch.

they are all tanned; for an account of which operation, see the article *Turbot*.

When the fishermen on the Scotch coast have plenty of salt, herrings sell for about six shillings a barrel. As their salt is expended, the price falls to five, four, three, two, and one shilling per barrel, sometimes even to six-pence or eight-pence; below which prices the men will seldom shoot their nets, as a less price is not sufficient to indemnify them for the trouble of catching them; but it sometimes happens that a barrel of fine fresh herrings may be purchased for a single chew of tobacco. A barrel contains from six hundred to sixteen hundred fish, according to their size. After the nets are hauled, the fish are thrown upon the deck of the vessel, and each of the crew has a certain task assigned to him. One part is employed in opening and gutting them, another in salting, and a third in packing them in the barrels in layers of salt. The red herrings lie twenty-four hours in the brine; they are then taken out, strung by the head on little wooden spits, and hung in a chimney formed to receive them; after which a fire of brush-wood, which yields much smoke, but no flame is kindled under them, and they remain there till sufficiently smoked and dried, when they are put into barrels for carriage.

Herrings become very soon tainted after they are dead; in summer they are insensibly worse for being out of the water only a few hours; and

Description—Numerous on the western coasts.

if exposed only a few minutes to the rays of the sun, they are quite useless, and will not take the salt. There are about eleven species of the herring, the principal of which are as follow.

THE PILCHARD.

THIS is a smaller species of herring: the chief difference between them is, that the body of the pilchard is round and thick; the nose shorter in proportion, turning up, and the under jaw shorter. The back is more elevated, and the belly not so sharp. The scales also adhere very closely, while those of the herring easily drop off. The dorsal fin in the pilchard is also so backward, that the fish, when held up by it, dips from an horizontal line forward; but when the herring is held up by its dorsal fin, it remains in equilibrium.

About the middle of July the pilchards appear in vast shoals off the coasts of Cornwall. These shoals remain till the latter end of October, when it is probable they retire to some undisturbed deep, at a little distance, for the winter. It has been supposed, but improperly, that, like the herring, they migrated into the Arctic regions. If pilchards performed any migration northwards, we should certainly have heard of their being occasionally seen and caught on their passage; but of this we have no one authenticated

Pilchard fishery.

instance. The utmost range of the pilchards seems to be the Isle of Wight in the British, and Ilfracomb in the Bristol Channel. Forty-five years back, Christmas was the time of their departure, which alteration in time is a very singular fact, authenticated by Dr. Maton.

Dr. Borlase's account of this fishery is as follows:—"It employs a great number of men on the sea, training them thereby to naval affairs; employs men, women, and children, at land, in salting, pressing, washing, and cleaning; in making boats, nets, ropes, casks; and in all the trades depending on their construction and sale. The poor are fed with the offals of the captures, the land with the refuse of the fish and salt, the merchant finds the gains of commission and honest commerce, the fisherman the gains of the fish. Ships are often freighted hither with salt, and into foreign countries with the fish, carrying off, at the same time, part of our tin. The usual produce of the number of hogsheads exported each year, for ten years, from 1747 to 1756 inclusive, from the four ports of Fowey, Falmouth, Penzance, and St. Ives,—it appears that Fowey has exported yearly 1732 hogsheads; Falmouth, 14,631 hogsheads and two thirds; Penzance and Mounts-bay, 12,149 hogsheads and one third; St. Ives, 1,282 hogsheads; in all amounting to 29,795 hogsheads. Every hogshead, for ten years last, together with the bounty allowed for each hogshead exported, and the oil made out

of each hogshead, has amounted, one year with another, at an average, to the price of one pound thirteen shillings and three-pence; so that the cash paid for pilchards exported has, at a medium, annually amounted to the sum of 49,532*l.* 10*s.*"

Dr. Maton, in the first volume of his "Observations on the Western Counties," informs us that he and a friend hired a boat to go out and see the pilchard-fishing at Fowey, near Looe, in Cornwall. "The fishing-boats," says our author, "which are pretty numerous, are usually stationed in ten fathoms water, and clear of all breakers. Light sail-boats keep out at a little distance before them, to give notice to the fishermen of the approach of a shoal. Persons are also frequently stationed on the neighbouring rock to watch the course of the fish; these are called *huiers* from the circumstance of their setting up a *hue* to the fishermen. The nets, which are seines, are sometimes two hundred fathoms or more in circumference, and about eighteen deep. Some of them are said to hold upwards of two hundred hogsheads of fish, each containing about three thousand. About thirty thousand hogsheads are here looked upon as a tolerably good produce for one season; but it happens now and then that the fishery almost entirely fails." About ten years before our author was at this place, the fishermen and their families had been compelled to live for some time solely on limpets and other

Descriptions.

shell fish, which they cannot in any other circumstances be prevailed on to eat.

The dog-fish are great enemies to the pilchards, often devouring them in amazing numbers.

THE SPRAT

IS a native of the European seas, greatly resembling the herring, though a good deal smaller, and having thirteen rays in the back fin. They are caught in the Thames from the beginning of November till March, and afford a very seasonable relief to the poor of the metropolis.

Sprats are sometimes pickled, and rendered in flavor scarcely inferior to anchovies, from which they are only to be distinguished by their bones being indissoluble. At Yarmouth they are cured like red herrings.

THE SHAD

HAS a forked snout, and black spots on its sides: it frequents the river Thames about the latter end of May, or the beginning of June, and is considered a very coarse and insipid fish. The Severn, however, affords it in very great perfection; and on its first appearance, which is usually in May, or in very warm seasons in April, it is esteemed a delicacy, especially in that part of

the river that flows near Gloucester, where they are taken in nets, and often sell dearer than salmon. The London fishmongers distinguish the Severn from the Thames shad by calling the former *alose*. The old fish come from the sea into the river in full roe, but where they spawn is not determined, for their fry has not yet been ascertained. The Severn shad is sometimes, though rarely, caught in the Thames. They continue in the Severn about two months, and are succeeded by a variety called the *twaite*, which is taken in great numbers, but held in as little regard as the shad of the Thames. The chief difference between these varieties are, that the *twaite* has three or four black spots on the sides, placed one under the other; if only one spot, it is always near the gill. The weight of the shad is seldom less than four pounds; that of the *twaite* never exceeds two. Ancient naturalists say, that the shad is a fish of passage of the Nile; that it is also found in the Mediterranean, near Smyrna, and on the coast of Egypt, near Rosetta; and that in the months of December and January it ascends the Nile as high as Cairo, where the people stuff it with pot-marjoram; and when dressed in that manner, it will nearly intoxicate the eater.

THE ANCHOVY

IS about three inches long, though mention is made of some being six inches and a half. The nose is pointed; the edge of the jaws finely serrated, the upper being longer than the under; the eyes large; the body round and slender; the back of a dusky green color; the sides and belly of a silvery white; between the ventral fins it has a long pointed scale, and the tail is forked.

At different seasons it frequents the Atlantic ocean and the Mediterranean sea, passing through the Straights of Gibraltar towards the Levant in the months of May, June, and July. The greatest fishery is at Gorgano, a small west isle of Leghorn, where they are taken at night in nets, into which they are allured by lights fixed to the stern of the vessels. When cured, their heads are cut off, their gall and guts taken out, and then salted, and packed in barrels. It scarce needs be mentioned, that, being put on the fire, they dissolve in almost any liquor. They are well tasted when fresh.

Of the other species of herring, which are chiefly natives of China, Surinam, Asia, &c little is known to interest the reader.

THE FLYING FISH.

THE winged flying fish, if we except its head and flat back, has, in the form of its body, a great resemblance to the herring. It is generally nine inches long, and full four round at the thickest part. The skin is uncommonly firm, and the scales are large and silvery. The pectoral fins are very long; and the dorsal fin is small, and placed near the tail, which is forked. The eye, in consequence of the largeness of the head, is admirably situated for discovering danger or prey; and when pushed out of the socket, which the fish can do considerably, its sphere of vision is greatly increased.

The flying fish inhabits the European, the American, and the Red seas; but is chiefly found within the tropics. The wings, with which they have the power of raising themselves into the air, are nothing more than large pectoral fins, composed of seven or eight ribs, or rays, connected by a flexible, transparent, and glutinous membrane. They have their origin near the gills, and are capable of considerable motion backwards and forwards. These fins are used also to aid the motion of the fish in the water; and if we are to judge from the great length and surface of the oars, comparatively with the size of the body, the fish should be able to cut their way through the water with great velocity.

Capable of flying and swimming.

The fore part of the body is fortified just behind the gills by a flat bone on each side, answering all the purposes of clavicles and scapulæ in land animals; and on the posterior part of it, the articulation is made with the wing.

In flying, as it is termed, not only the wings and fins of these fish are much expanded, but also their tails; they skim along the surface of the deep somewhat in the manner of a swallow, but in straight lines; and from the blackness of their backs, the whiteness of their bellies, and forked expanded tails, they have much the same appearance. They fly fifty or sixty yards at one stretch; and repeat the exertion again and again by a momentary touch of the surface, which gives them new vigor for a new departure. They generally rise in shoals; and are found in great quantities between lat. 13 deg. and 10 deg. N. and from 20 to 30 W. as also between the tropics in the Atlantic, and in the Indian ocean; and the power of exerting itself in both elements, is said to furnish one of the most entertaining spectacles those seas can exhibit. The efforts to seize on the one side, and the arts of escaping on the other, are perfectly amusing. The shark, the porpoise, the dolphin, and the dorado, are seen upon this occasion darting after their prey, which will not leave the water, while it has the advantage of swimming, in the beginning of the chase; but, like an hunted hare, being tired at

last, it then has recourse to another expedient for safety, by flight. The long fins, which began to grow useless in the water, are now exerted in a different manner and different direction to that in which they were employed in swimming; by this means the timid little animal rises from the water, and flutters over its surface for sixty or seventy yards, till the muscles employed in moving the wings are enfeebled by that particular manner of exertion, and the fish is obliged to immerge into its own element. In a short time, however, they have acquired a fresh power of renewing their efforts in the water, and the animal is capable of proceeding with some velocity by swimming; but still the active enemy keeps it in view, and drives it again from the deep, till at length the poor little creature is seen to dart to shorter distances, to flutter with greater effort, and to drop down at last into the mouth of its fierce pursuer; but, should it escape from its enemies of the deep, the tropic bird and the albatross, the booby and the man of war, are for ever on the wing to seize it.

It has been inconsiderately remarked, that "all animated nature seems combined against this little fish, which possesses the double powers of swimming and flying only to subject it to greater dangers. If it escape its enemies of the deep, it is only to be devoured by the sea fowl, which are waiting its appearance in the air." Its destiny is, however, by no means peculiarly se-

Slender flying fish—Great flying fish.

vere: we should consider that, as a fish, it often escapes the attack of birds; and, in its winged character, the individuals often throw themselves out of the power of the aquatic race.

They are frequently either unable to direct their flight out of a straight line, or else they become exhausted on a sudden; for sometimes whole shoals of them fall on board the ships that navigate the seas of warm climates.

This fish was known to the ancients, for Pliny mentions it under the name of *hirundo*, and relates its faculty of flying. The taste of it somewhat resembles mackrel.

The slender flying fish corresponds with the preceding in having the sides of the belly ridged, but from which it may be discovered at first sight by the slenderness of the body and the great length of the ventral fins. This species has been generally confounded with the former, or overlooked. Probably the ventral fins may assist its flight. It is not known what ocean or sea it inhabits.

The great flying fish agrees with the slender one in the great length of its ventral fins, but differs in having a thick body. This fish is near two feet long, the common flying fish not more than eight, nor the slender sort more than six inches.

THE KITE FISH.

THIS has a kind of resemblance to the flying fish. The head is square; two strong spines at the hinder part gill cover ending in a long strong spine; the body roundish and slender; on the scales run lengthwise a scalloped thin ridge; between the dorsal fins a single short spine; the ventral fins very large, reaching to the tail; four appendages under the throat, united in a web; the tail forked; and its length one foot and a half. When fresh taken, the back is either a light or dusky red; the belly white, and the ventral fins prettily spotted.

The kite fish inhabits the Atlantic and Indian oceans, and the Mediterranean sea. When pursued by the dorado, &c. it quits the water, and by means of its ventral fins flies in the air about a stone's cast.

It is common in the fish markets of Italy, Sicily, and Malta.

CHAP. IX.

The *sucking fish* beneath, with secret chains
Clung to the keel, the swiftest ship detains.

JONES'S OPPIAN.

THE SUCKING FISH.

THERE are only three known species of the sucking fish; these are occasionally seen in the Mediterranean sea and the Pacific ocean. The common sucking fish, which inhabits most parts of the ocean, is usually about a foot in length; the head large, equal in bigness to the body, which grows smaller gradually to the tail, which is small. The back is convex and black, and the belly white. It has six fins, two growing from behind the gills, two more under the throat, a long one on the back, and opposite to it, under the belly, another of the same form and size; the tail is forked.

What this fish has peculiar to itself is, that the crown of the head is flat, and of an oval form, with a ridge, or rising, running lengthways; and

crossways to this, sixteen ridges, with hollow furrows between, by which structure it can fix to any animal or other substance, as they are often found adhering to the sides of ships, and the bodies of sharks and other large fish. But the notion that this small fish was able to stop a ship under sail, or a whale in swimming, is entirely fabulous; all they can do is no more than what shells, or corals, and other foulnesses, which make her sail somewhat the slower. Abbé Fortis says, that once sailing in the gulf of Venice in a small bark, the man at the helm suddenly called to his companion to kill a remora, which had fixed itself to the rudder, and which did then, as he had often experienced, sensibly both retard and alter the course of the vessel. Thus, what might have happened to a boat, is by Oppian and Pliny transferred to a galley, or ship.

The sucking fish inhabits most parts of the ocean, and is often found so strongly adhering to the sides of sharks, as before observed, by means of the structure of its head, as not to be got off without great difficulty. "Five of them," says Catesby, "have been taken from the body of a single shark. I have also seen them," adds he, "disengaged, and swimming very deliberately near the shark's mouth, without his attempting to swallow them, the reason of which I am not able to give." St. Pierre says, he has put some

Used for catching other fish.

of them on an even surface of glass, from which he could not afterwards remove them.

Among other absurd notions which the ancients entertained of this fish, they also fancied that, in what manner soever it was administered, it was fatal in affairs of love, deadening the warmest affections of both sexes.

The Indians of Jamaica and Cuba formerly used the sucking-fish in the catching of others, somewhat in the same manner as hawks are employed by a falconer in seizing birds. They kept them for the purpose, and had them regularly fed. The owner, on a calm morning, would carry one of them out to sea, secured to his canoe by a small but strong line, many fathoms in length; and the moment the creature saw a fish in the water, though at a great distance, it would dart away with the swiftness of an arrow, and soon fasten upon it. The Indian, in the mean time, loosened and let go the line, which was provided with a buoy that kept on the surface of the sea, and marked the course the sucking fish had taken; and he pursued it in his canoe until he perceived his game to be nearly exhausted and run down. He then, taking up the buoy, gradually drew the line towards the shore; the sucking fish still adhering with so inflexible a tenacity to his prey as not easily to be removed. Oviedo says, he has known turtle taken by this mode, of a bulk and weight that no single man could support.

Sucking fish are often eaten, and much admired: in taste they are said very greatly to resemble fried artichokes.

THE CHÆTODON, or SHOOTING FISH.

THE head and mouth of the chætoda are small, and they have the power of pushing out and retracting the lips so as to make a tubular orifice. The teeth are mostly bristle-shaped, flexile, movable, closely set, and very numerous. The gill-membrane has from three to six rays. The body is scaly, broad, and compressed; and the dorsal and anal fins are generally terminated with prickles.

The principal species of this fish is the beaked chætodon, which frequents the shores and mouths of rivers in India, and about the Indian islands. It is somewhat more than six inches in length, and is of a whitish or very pale brown color, with commonly four or five blackish bands running across the body, which is ovate and compressed. The eyes are large, and the irides of a golden color; the snout is lengthened and cylindrical; the dorsal and anal fins are very large, and on the former is a large eye-like spot.

The beaked chætodon, or shooting fish, feeds principally on flies and other small insects that hover about the waters it inhabits; and the mode

Remarkable mode of taking its prey.

of taking its prey is very remarkable. When it sees a fly at a distance alighted on any of the plants in the shallow water, it approaches very slowly, and with the utmost caution, coming as much as possible perpendicularly under the object; then putting its body in an oblique direction, with the mouth and eyes near the surface, remains a moment immovable. Having fixed its eyes directly on the insect, it shoots at it a drop of water from its tubular snout, but without showing its mouth above the surface, from whence only the drop seems to rise. This is done with so much dexterity, that, though at the distance of four, five, or six feet, it very seldom fails to bring the fly into the water. With the closest attention the mouth could never be discovered above the surface, although the fish has been seen to eject several drops, one after another without leaving the place, or in the smallest apparent degree moving its body.

M. Hommel, the governor of the hospital at Batavia, near which place this species is sometimes found, was determined, if possible, to convince himself of the truth of this singular action by ocular demonstration. For this purpose he ordered a large wide tub to be filled with sea water; he then had some of these fish caught and put into it, and the water was changed every other day. After a while they seemed reconciled to their confinement, and he then tried the experiment. A slender stick, with a fly fastened at

Description—Only two species.

the end, was placed in such a manner on the side of the vessel, as to enable the fish to strike it; and it was not without inexpressible delight that he daily saw them exercising their skill in shooting at it with amazing force, and seldom missing their mark.

The flesh of this species is white, and very good eating.

THE SWORD FISH.

THE head of this fish is furnished with a long, hard, sword-shaped upper jaw, whence it takes its name. The mouth has no teeth; the gill membrane is eight-rayed; and the body is rounded, and has no apparent scales.

Sword fish are very large and powerful animals, often growing to the length of twenty feet and upwards. Their voracity is unbounded, for they attack and destroy almost every thing living that comes in their way. The larger fish they penetrate with their long snout, few of which, when within sight of them, can either withstand or avoid its shock. There are but two species, one of which is only found in the European seas; the other, called the Indian, or broad-finned sword fish, inhabits the Brazilian and East Indian seas, and also the Northern ocean. The body is of a silvery blueish white, except the upper parts of the back, and the head and tail, which are of

Remarkable circumstance.

a deep brown. The skin is smooth, and without any appearance of scales. From the long sharp-pointed process in front of the head, it would seem, on a cursory view, to be allied to the European species; but it differs from this in having an extremely broad back fin, and two long sharp-pointed appendages proceeding from the thorax. It frequently grows to the length of twenty feet and upwards, and is a very powerful fish.

In 1725, when his Majesty's ship *Leopard*, after her return from the coast of Guinea and the West Indies, was ordered to be cleaned and refitted for the Channel service, in stripping off her sheathing the shipwrights found in her bottom, pointing in a direction from the stern towards the head, part of the sword or snout of one of these fish. On the outside this was rough, not unlike seal-skin, and the end, where it was broken off, appeared like a coarse kind of ivory. The fish, from the direction in which the sword lay, is supposed to have followed the ship when under sail. It had penetrated through the sheathing, which was an inch thick; passed through three inches of plank, and beyond that four inches and a half into the timber. The force requisite to effect this (since the vessel sailed in a direction from the fish) must have been excessively great, especially as no shock was felt by the persons on board. The workmen on the spot declared it impossible, with a hammer

Another extraordinary account.

of a quarter of a hundred weight, to drive an iron pin of the same form and size into that wood, and to the same depth, in less than eight or nine strokes, whilst this had been effected by only one.

A letter was written to Sir Joseph Banks, as President of the Royal Society, from the captain of an East Indiaman, about twenty years ago, accompanied with an account of another instance of the amazing strength which this fish occasionally exerts; the bottom of this ship having been pierced through in such a manner that the sword was completely embedded, or driven through its whole length, and the fish killed by the violence of the effort. A part of the bottom of the vessel, with the sword embedded in it, is now lodged in the British Museum.

The sword fish and the whale are said never to meet without coming to battle; and the former has the repute of being always the aggressor. Sometimes two of them join against one whale, in which case the combat is by no means equal. When the whale discovers the sword fish darting upon him, he dives to the bottom, but is closely pursued by his antagonist, who compels him again to rise to the surface. The battle then begins afresh, and lasts till the sword fish loses sight of the whale, who is at length compelled to swim off, which his superior agility allows him to do.

The whale, as we are told by some navigators,

Battles between the sword fish and whale.

at the sight of this animal seems agitated in an extraordinary manner, leaping from the water as if with affright; wherever it appears, the whale perceives it at a distance, and flies from it in the opposite direction. The whale has no instrument of defence except its tail, with which it endeavors to strike the enemy, and a single blow taking place would effectually destroy its adversary; but the sword fish is as active as the other is strong, and easily avoids the stroke; then bounding into the air, it falls upon its enemy, and endeavors not to pierce with its pointed beak, but to cut it with its toothed edges. The sea all about is soon dyed with blood, proceeding from the wounds of the whale; while the enormous animal vainly endeavors to reach its invader, and strikes with its tail against the surface of the water, making a report at each blow louder than the noise of a cannon.

The sword fish, however, in piercing the whale's body with his tremendous weapon, seldom does any great damage to the animal, not being able to penetrate much beyond the blubber.

**THE THREE-SPINED STICKLEBACK,
or PRICKLEBACK.**

THIS species of the sticklebacks seldom exceeds two inches in length, and is very common

in many of our rivers, particularly in those of Lincolnshire. They have three sharp spines on their back, according to their name, which are their instruments both of offence and defence, and are always erected on the least appearance of danger, or whenever they are about to attack other fish. The body near the tail is somewhat square, and the sides are covered with transverse bony plates. Their usual colors are olive green above, and white on the under parts; but in some individuals the lower jaw and the belly are of a bright crimson. These fish likewise abound on the Prussian coast near Dantzick, where they are used for making oil, but more especially for feeding ducks and fattening swine.

Notwithstanding the smallness of their size, they are, by feeding with great voracity on the fry and spawn of other fish, greatly detrimental to the increase of almost all the species among which they inhabit. Mr. Arderon, of Norwich, informs us in the Phil. Trans. that one which he had in a glass devoured in five hours no fewer than seventy-four young dace, each about an inch and a half long, and of the thickness of a horse-hair, and would have done the same every day, had they been given to it. The fish was put by Mr. Arderon into a glass jar of water, with some sand at the bottom, for the purpose of trying some experiments on it, as well as for the sake of ascertaining its manners, as far as possible, in a confined state. For a few days it

Frequently numerous in the river Welland.

refused to eat; but, by frequently giving it fresh water, and by coming often to it, it began to eat the small worms that were now and then thrown into the jar; soon afterwards it became so familiar as to take them from the hand; and at last it even became so bold, as, when it was satiated, or did not like what was offered to it, to set up its prickles, and strike with its utmost strength at the fingers, if put into the water to it. It would suffer no other fish to live in the same jar, attacking whatever were put in, though ten times its own size. One day, by way of diversion, a small fish was put to it. The prickleback immediately assaulted and put it to flight, tearing off part of its tail in the conflict; and, had they not been then separated, he would undoubtedly have killed it. These diminutive fish do not easily fall a prey to the other voracious tenants of the deep, who are afraid of its spines. It has been observed by several naturalists of celebrity, that they are very much tormented with worms in the intestines.

Such amazing shoals of this fish come in the river Welland, near Spalding in Lincolnshire, as, during their progress up the stream, to appear in a vast body occupying the whole width of the river. These are supposed to be the overplus of multitudes collected in some of the fens. When this happens they are taken as manure for the land; and an idea may be formed of their numbers from the circumstance that a man, employed

by a farmer to catch them, got, for some time, four shillings a day by selling them at a half-penny a bushel. Mr. Pennant informs us, their appearance in those parts is not annual, like that of the herring or mackrel, but takes place after an interval of seven or eight years. The cause of these periodical visits is conjectured to be, the vast quantities which have bred in the intermediate time upon some of the adjacent shoals or banks, where (small as they are) finding themselves straitened for room, immense colonies are dispatched from the mother-settlement in search of a more commodious habitation.

The great exertions they use, in getting from one place to another, where obstacles intervene, are very extraordinary; for, though the largest among them is seldom known to be more than two inches in length, they have been seen to spring a foot and a half (nine times their own length) in perpendicular height from the surface of the water, and in an oblique direction much farther.

These fish spawn in April and June on the aquatic plants; they multiply very fast, but are very short-lived, scarcely ever attaining the third year. They are too small, and perhaps too bony, to be of any essential service as food to mankind.

THE TEN-SPINED STICKLEBACK.

THIS is still less than the three-spined stickleback, never exceeding an ounce and a half in weight. Bloch declares that it is the smallest fish that exists, and the only kind that is useless to man. It is found in the Baltic sea and German ocean, and in all the bays and creeks communicating with them. But it is seldom taken, being so small as to pass through the meshes of the net; and even if the fishermen find any of them among a net of other fish, they throw them away as good for nothing.

THE FIFTEEN-SPINED STICKLEBACK, or GREAT STICKLEBACK.

THIS fish, which is the largest species of the sticklebacks, is slender, being only an inch thick and nine in length; the snout is long, and the body of a pentagonal figure towards the tail, which is flat. The mouth is small, and the upper jaw projects beyond the lower. The gills and the bony plate on the belly are brown upon the upper part, silvery and streaked upon the lower. It has two pectoral fins, one dorsal, rising in a triangular form from the middle of the back. Between this and the head are fifteen distinct spines inclined towards the tail, which, when depressed, are insensible to the touch. The fins of

the belly consist of two spines, the foremost of which is the longest. In the fin at the anus there is also a curved spine, but the other fins are soft and ramified.

The fifteen-spined sticklebacks, like the last mentioned species, are found in the Baltic sea and German ocean; they are very common in Holland, and also near Lubeck in the duchy of Holstein. M. Bloch says, that their ordinary size does not exceed seven inches, and that he has found small crabs in their stomach. The great stickleback does not ascend the rivers like the other kinds, never leaving the sea, where it is taken among other fish. Large quantities are sometimes caught by kindling a fire on the shore, which draws them in shoals to the nets. A kind of lamp oil is extracted from them, and what remains is used as manure. They are, however, frequently eaten by the poor.

The first who published a description of this fish was Schoneveld. Succeeding naturalists have bestowed on it a small portion of attention, otherwise Linnæus, Mr. Pennant, and their copyists, would not have asserted that the fins of the belly are wanting. M. Bloch describes the roe as consisting of two cylindrical parts, joined together at the umbilical aperture, and containing one hundred and eighty four eggs of a pale yellow color, as large as grains of millet.

Description—Excessive voracity.

THE DOREE.

THE doree, which is known by a brown spot on each side, in shape somewhat resembles a flounder. The head is flat laterally, and the mouth immoderately large. Both the back and belly are armed with sharp points, the former has a single row of them to the second dorsal fin, from which, to the tail, it has a double row of unequal length. The scales are very small and thin, which has caused some ichthyologists to doubt their existence. The spots on the sides have made the doree a rival of the haddock for the honor of St. Peter's touch when he took the tribute money from its mouth. Aldrovandus says, that it was frequently hung up in Roman catholic churches, on account of the sanctity which this circumstance was supposed to have imparted to it. It grows to the length of a foot, or a foot and a half, and weighs ten or twelve pounds.

This fish is found in the German ocean. It is a native of the Mediterranean, so that when Ovid speaks of it as a "rare fish," it must be presumed that he alludes to the quality of its flesh. At Hamburg it is called by the fishermen the king of herrings. Its excessive voracity causes it to bite at every kind of bait. It is found on the shores, whither it pursues the fish that frequent them for the purpose of spawning.

The flesh of the doree is an excellent dish, especially when fat, but from its hideous appear-

Dr. Mortimer's description.

ance, it is said to have been banished from the English tables, till introduced by the celebrated comedian and epicure Quin; since whose time it has been justly esteemed one of the greatest delicacies.

THE OPAH,

WHICH, though belonging to the genus of doree, far exceeds that fish in magnitude, measures three or four feet in length, upwards of two in breadth, and sometimes weighs one hundred and forty pounds. It is so much compressed laterally, that its greatest thickness does not exceed four inches.

The following is an account drawn up by Dr. Mortimer, and inserted in the Phil. Trans. (1750) relative to one which was taken on the coast near Leith, in Scotland. "This fish is smooth-skinned, has no scales or teeth; it has one erect fin on its back, which arises below its neck, and runs within a little of its tail; on each side, about the middle, between its back and belly, a little forward of the vent, runs one fin within a little of the tail; the tail is large and forked; the eyes are large, the irides are scarlet, encompassed with a circle of gold color verged with scarlet; its nostrils are placed above its eyes; the back and upper part of the body quite to the tail, was of a dark blue or violet color: these and the sides of

Dr. Mortimer's account.

the body, which were of a bright green, were all speckled with oblong white spots; the chaps were of a pale red; the nose, gills, and belly, were of a silver color, and all the fins of a bright scarlet. It was three feet seven inches long, and three feet ten inches round the thickest part; it weighed eighty-two pounds. Its mouth was small, its tongue thick, almost like the human tongue in shape, but rough and thick set with beards or prickles which pointed backwards, so that any thing might easily pass down, but could not easily slip back again; therefore these might serve instead of teeth for retaining its prey or food; its gills resembled those of the salmon; its body grows very taper towards the tail, and from being compressed to ten inches thickness, becomes near the tail almost round, and about three inches thick. The whole shape of this fish much resembles that of the sea-bream, but it differs in size, being much larger, and in not having teeth or scales. The fin standing erect on the back has some aculei next the neck, and rises up to eight inches, but in the middle diminishes to one inch, and near the tail rises again to three inches; the belly fin, opposite to this, spreads three inches near the tail, and diminishes towards the vent; the tail fin is forked, and spreads twelve inches; the gill fins are nine inches long and three wide at their basis. It seems to be a new species of fish not yet described by any author."

Another fish of this species was taken near Newcastle in 1767, and Mr. Harrison has described it in the British Zoology. A third, weighing an hundred and forty pounds, was caught at Brixham, in Torbay, in 1772. A dried specimen of the opah is preserved in the British Museum. It is three feet five inches in length, and measures one foot seven inches where broadest.

The opah is one of the most beautiful of the inhabitants of the deep; its color being a transparent scarlet, burnished over with gold, and variegated with oblong silver spots, of various sizes. The fins are likewise of the same beautiful scarlet color as the body, so that the appearance of this fish is uncommonly brilliant.

This fish is not mentioned by Linnæus or Willoughby, from which it may be presumed to be a rare fish every where. Only four or five of this species have ever been taken on the English shores. Pennant describes the flesh as resembling beef in taste and appearance, and says, that the breast consisted of a sharp bone, similar in form to the keel of a ship.

THE DORADO

IS one of the most beautiful, most active, and most voracious of the spinous kind; they are in a state of continual warfare, always employed

Extreme beauty—Fierceness.

either in defending themselves against the shark, or darting after the smaller fish. It is chiefly found in the tropical climates; is about six feet long, yet not thicker than a salmon; and, furnished with a full complement of fins, cuts its way through the water with amazing rapidity. Its eyes are placed on each side of the head, large and beautiful, surrounded with circles of shining gold; the back enamelled all over with spots of a blueish green and silver; the tail and fins of a gold color, and all together possessing such a brilliancy of tint as nothing but Nature's pencil could produce. It is an enemy to the winged flying fish.

THE SEA-WOLF

IS a most ravenous and fierce fish, and, when taken, fastens on any thing within its reach; the fishermen, dreading its bite, endeavor, as soon as possible, to beat out its fore teeth, and then kill it by striking it behind the head. Schoneveld relates, that its bite is so hard, that it will seize an anchor, and leave the marks of its teeth in it. It seems to be confined to the northern part of the globe, being found in the sea of Greenland, in those of Iceland and Norway, on the coasts of Scotland and of Yorkshire, and lastly, in that part of the German ocean which washes the shores of Holland.

Description.

The sea-wolf grows to a large size; those on the Yorkshire coast are sometimes found of the length of four feet; according to Dr. Johnson, they have been taken near Shetland seven feet long, and even more. The head is a little flattened on the top; the nose blunt; the nostrils are very small; the eyes small, and placed near the end of the nose. The teeth are very remarkable, and finely adapted to its way of life. The fore teeth are strong, conical, diverging a little from each other, stand far out of the jaws, and are commonly six above and the same below, though sometimes there are only five in each jaw; these are supported within side by a row of lesser teeth, which makes the number in the upper jaw seventeen or eighteen, in the lower eleven or twelve. The sides of the under jaw are convex inwards, which greatly adds to their strength, and at the same time allows room for the large muscles with which the head of this fish is furnished. The grinding teeth of the under jaw are higher on the outer than the inner edges, which inclines their surfaces inward; they join to the canine teeth in that jaw, but in the upper are separate from them. In the centre are two rows of flat strong teeth, fixed on an oblong basis upon the palate and nose. The teeth of the anarrhicus are often found fossil, and in that state called busonites, or toad-stones; these were formerly much esteemed for their imaginary virtues, and were set in gold, and worn as rings. The two

Description—Food.

bones that form the under jaw are united before by a loose cartilage, which mechanism, admitting of a motion from side to side, most evidently contributes to the design of the whole, viz. a facility of breaking, grinding, and comminuting its testaceous and crustaceous food. At the entrance of the gullet, above and below, are echinated bones; these are very small, being the less necessary, as the food is in a great measure comminuted in the mouth by aid of the grinders. The body is long, and a little compressed sideways; the skin smooth and slippery, it wants the lateral line. The pectoral fins consist of eighteen rays; the dorsal fin extends from the hind part of the head to the tail; the rays in the fresh fish are not visible; the anal fin extends as far as the dorsal fin. The tail is round at its end, and consists of thirteen rays. The sides, back, and fins, are of a livid lead color, the two first marked downwards with irregular obscure dusky lines; these in different fish have different appearances: the young are of a greenish cast.

This fish feeds almost entirely on crustaceous animals and shell fish, such as crabs, lobsters, prawns, muscles, scollops, large whelks, &c.; these it grinds to pieces with its teeth, and swallows with the lesser shells. It does not appear they are dissolved in the stomach, but are voided with the fæces, for which purpose the aperture of the anus is wider than in other fish of the

same size. It is full of roe in February, March, and April, and spawns in May and June.

This fish has so disagreeable and horrid an appearance, that nobody at Scarborough, except the fishermen, will eat it, and they prefer it to holibut. They always before dressing take off the head and skin.

THE GAR, NEEDLE, AND PIPE FISH.

THE gar fish belongs to the class of needle fish, which denomination they have received from the extreme length of their bodies in proportion to their thickness. They have no scales, but scuta or bucklers, with several angles. The hexagonal form of the body and the anal fin, are the distinguishing characters of the gar fish. The body is composed of eighteen scuta, and the tail of thirty-six, which form as many joints; the tail is square. It is found in the North and Baltic seas; it scarcely exceeds the length of a foot and the thickness of a finger. Besides the appellations of needle fish and gar fish, it is sometimes called by those of shorter pipe and horn fish.

The needle fish are natives of the ocean, and the North and Baltic seas. They are usually found in deep places near the coasts, where they are caught along with other fish. They produce their young in a perfect state, one after the other,

Pipe fish—Sea adder, or little pipe.

from eggs hatched in their bodies, like the sharks and rays. Having but little flesh they are fit only for baiting lines, and they are the more proper for this purpose as they are tenacious of life, and it is well known that fish bite more eagerly at a living bait than at a dead one.

The pipe fish is another species of the needle fish. Its body is of an heptagonal form, and is covered with twenty scuta; the tail is hexagonal, and consists of forty-three. These scuta are of the nature of horn, and form seven angles, three of which are on each side, and one in the middle of the belly. This fish is caught in the North and Baltic seas, and grows to the length of two or three feet. Like the gar fish, it is used as a bait. Pennant and Gronovius make but one species of the gar and pipe fish; but, besides the difference in size, the figure of the heptagonal bucklers of the latter, forms a marked distinction between them and those of the former, which are hexagonal.

The sea adder, or little pipe, is nearly round, having only some very small and scarcely perceptible angular projections on the sides. It has but one fin, and the body is divided into joints like that of the common worm. It grows to the length of two feet, and is not thicker than a swan's quill. It inhabits the North and Baltic seas, and is of the same nature as the two former fish.

CHAP. X.

"If I be not asbamed of my soldiers I am a *sous'd gurnet*."

SHAKESPEAR.

THE GURNARD, or GURNET.

GURNARDS are known by the articulated processes situated before the pectoral fins. These are separated from each other, consist of several small joints, and remain in the position in which they are bent, so that they have very justly been called fingers by many writers; the fish, doubtless, use them to lay hold of their prey. The head of the gurnard is large, and the tail small; the former is cased with a bony substance, which serves for a helmet, and has several sharp points upon the top of the head and on the sides. Several species, likewise, have two spines in the front. These fish are carnivorous; when touched they erect the dorsal fin to defend themselves by means of the spines with which it is armed; at the same time they compress their bodies, and expel the water and air with a considerable noise.

Grey gurnard—Red gurnard.

In the western parts of the British coast, where it is most frequently caught, the meaner sort of people parboil, and afterwards steep it in pickle, calling it a "sous'd gurnet," a dish which was consequently never esteemed, as appears from Falstaff's words, (Henry IV. Part II.) which are prefixed to this chapter.

The grey gurnard has a long tapering body, and a larger head than the other species of gurnards. On the sides of the head are observed several stars, consisting of a great number of small silvery points, streaked at intervals with red. It is found in the German ocean, in the Baltic, and on the coasts of South America. In the Baltic it is usually about a foot and a half in length, but on the English shores from two to three feet. Frezier relates, that it is found in great numbers on the coast of Chili, in the road of Valparaiso, and that its flesh is of very good flavor. The gurnard inhabits the bottom of the sea, where it seeks crabs and muscles. It spawns in May and June. At that season it repairs to the coasts, where it deposits its eggs. The gurnard is so voracious as to bite at a bait of any kind of fish, or even at a piece of red cloth.

The red gurnard receives its name from its brilliant red color, and is distinguished by a black spot on the first dorsal fin. It is found in the same waters as the grey gurnard, and also near the Cape of Good Hope. It does not exceed a foot in length. It is extremely beautiful

Sapphirine gurnard—Flying gurnard.

in the water; when taken out of the water, if the sun chance to shine upon it, the various hues with which it appears tinged form a truly charming spectacle. The red gurnard is a voracious fish; it appears on the coast in spring to deposit its spawn. Its flesh is much more firm and tender than that of the grey gurnard, being very white in season, which is in spring, and during the months of June and July; and it possesses the advantage of having scarcely any bones. It is remarkable that the red gurnard retains its beautiful color even after being boiled.

The sapphirine gurnard is a beautiful fish, and remarkable for the great breadth of the pectoral fins, which are of a pale green, finely edged and spotted with a rich deep blue. The dorsal fins are lodged between two rows of spines, of a serrated form; the back is of a greenish cast; the sides are tinged with red, and the belly is white. It is about two feet long, is found in the same seas, and lives on the same kind of food as the two preceding species. It inhabits the deep water of the open sea, and by the great size of its pectoral fins is enabled to swim with extraordinary rapidity. The flesh of the sapphirine gurnard is rather hard. In Denmark it is salted, dried in the open air, and used for victualling ships.

The flying gurnard is a highly singular and beautiful species, according to Dr. Shaw's account of it. Its length is about twelve inches;

Description.

the color crimson above, pale or whitish beneath; the head blunt, and armed on each side with two very strong and large spines, pointing backwards; the whole body covered with extremely strong carinated and sharp-pointed scales, so united as not to be distinctly separable; the first dorsal fin pale violet, crossed with deeper lines, and at its origin two separate rays longer than the rest; the second dorsal fin pale, with the rays barred with brown; the pectoral fins extremely large, transparent, of an olive green, richly varied with numerous bright blue spots; the pectoral processes six in number, and not separate, as in other species, but united into the appearance of a small fin on each side the thorax; the tail pale violet, with the rays crossed by dusky spots, and strengthened on each side the base by two obliquely transverse bony ribs or bars. It is a native of the Mediterranean, Atlantic, and Indian seas, where it swims in shoals, and is often seen flying out of the water to a considerable distance.

THE CUTTLE FISH.

THESE are, comparatively, large animals, some being two feet long and upwards. Their structure is very remarkable. The body is cylindrical, and, in some of the species, entirely covered with a fleshy sheath; in others, the

Possessed of great adhesive power.

sheath reaches only to the middle of the body. They have eight tentacula, or arms, besides two feelers, as they are called, which are much longer than the arms. Both the feelers and arms are furnished with strong circular cups or suckers, by means of which the animal seizes its prey, and firmly attaches itself to rocks or other hard substances. To do this it applies their surface, extended and plain, to the surface of the body, and then drawing them up in the centre by muscles contrived for the purpose, a vacuum is formed, and they adhere by the pressure of the external air. The adhesive power is so great, that it is more easy to ~~tear~~ tear off the arms than separate them from the substance to which they are fixed. If these arms happen by any chance to be broken off, they are soon afterward reproduced. The animals are also furnished with a hard, strong, and horny mouth, resembling, both in texture and substance, the beak of a parrot; with this they are enabled to break the shells of limpets and other shelled animals, on which they feed. In the back, under the skin, there is a kind of bone composed of thin parallel plates, one above another, and separated by little columns arranged in quincunx order. This bone is oval, thick toward the middle, and thin at the circumference. It is extremely light, and generally elastic, and in the living animal transparent like glass; the surface, in some species, is marked with longitudinal furrows. This bone, on account

Remarkable for emitting an inky fluid.

of its lightness, is sometimes called sea foam, or sea biscuit.

There is a vessel in the belly of these fish that contains a quantity of dark or inky fluid, which the animal emits, on contraction, when alarmed. This not only tinges the water so as to conceal its retreat, but is at the same time so bitter as immediately to drive off its enemies. Swammerdam was of opinion that the Indian ink is nothing more than this black fluid in an inspissated state, with the addition of perfumes. If Indian ink be dissolved in water in any considerable quantity, in the space of a few days it acquires a very high degree of putridity, clearly indicating its being formed of some animal substance; and no other seems to be so well calculated to compose it as this.

The young are produced from eggs deposited on the sea weed, in parcels exactly resembling a bunch of grapes. These are at first white, but after their impregnation by the male they become black; they are round, with a little point at the end, and in each of them is contained a cuttle fish, surrounded by a gelatinous fluid.

The female is always accompanied by the male, and when she is attacked he will brave every danger, and attempt her rescue even at the hazard of his own life. As soon as she observes her partner to be wounded she immediately escapes, her timidity not suffering her to afford him any assistance. When these animals are

Officinal cuttle fish—Eight-armed ditto.

dragged out of the water, they make a noise somewhat like the grunting of a hog.

The officinal cuttle fish was in great esteem by the ancients as food, and it is even yet used as such by the Italians. The bone in the back, when dried and pulverised, is employed by silversmiths for moulds, in which they cast their small work, as spoons, rings, &c. It is also converted into that useful article of stationery called pounce.

The eight-armed cuttle fish of the hot climates sometimes becomes of such a size as to measure twelve feet across its centre, and to have each of its arms between forty and fifty feet long. When the Indians go out in their canoes in places frequented by these cuttle fish, they are always in dread of their flinging their arms over and sinking them; on which account they are careful to take with them an ax to cut their arms off.

THE STAR FISH, or SEA STAR,

ARE usually found on the sand, or among the rocks on the sea shore, considerably below high-water mark. Their covering is a coriaceous crust, which defends them from the attacks of the smaller animals; and they have five or more rays proceeding from a centre in which their mouth is situated. Every ray is furnished with a

Powers of reproduction.

prodigious number of tentacula, or short soft and fleshy tubes, which appear to be of use not only in taking prey, and in aiding the motion of the animal, but also in enabling it to adhere to rocks and other substances, by which it withstands the force of the waves. In a single animal these tentacula have been found above fifteen hundred in number; and, when the star fish are thrown on their backs, these may be observed to be pushed out and withdrawn in the same manner as snails do their horns. The progressive motion of the star fish, which is with their rays, is very slow; and by the undulation of these they are enabled to swim. They possess considerable powers of reproduction; for if by any violence a ray is broken off, for most of them are very brittle, in the course of a short time a new one will appear. The mouth is armed with bony teeth, that are used in seizing and breaking the shells on which the animals feed; from hence a canal extends to each of the rays, runs through the whole length, and becomes gradually narrower as it approaches the extremity.

We are informed by a late writer, that if the star fish be drowned in brandy or spirits of wine, and the rays kept flat and expanded during the time, it is easy afterward to extract, by means of a pair of forceps, the stomach and intestines entire through the mouth.

THE ARBORESCENT STAR FISH.

THIS is a very singular species, which is occasionally found in most seas, but never in any great number. It is described by Shaw as having five equi-distant, thickly-jointed processes proceeding from its centre, each of which is divided into two other small ones, and each of these into two others still smaller; and this mode of regular subdivision is continued to a vast extent, and in the most beautiful gradation of minuteness, till at length the number of extreme ramifications sometimes amount to several thousands. One specimen, that measured three feet across, had five hundred and twelve extremities to each ray; so that in this the whole number was two thousand five hundred and sixty. By this most curious structure the animal becomes, as it were, a living net, and is capable of catching such creatures as are by nature destined for its prey, by the sudden contraction of its innumerable ramifications; and the unfortunate objects are secured by these beyond all possibility of escape.

The color of this fish when it is alive, or but just dead, is a reddish or deep carnation, but on being dried it becomes somewhat grey. It should be dried in the shade, in some open place, where the wind has free access to it; for in the sun it is apt to dissolve, and if placed too much in the shade it frequently becomes putrid.

Description.

This fish should be taken far out in the sea in order to be preserved whole and undamaged for cabinets, and the fishermen ought to be careful not to break off any of the limbs, and to prevent the animal from contracting and entangling its outer and most slender branches. The fishermen of the Cape of Good Hope get six, and sometimes even ten rix-dollars for one of these star fish.

SEA URCHINS.

THESE inhabitants of the sea, called also sea hedgehogs, are generally round, and shaped like a somewhat flattened ball. Their exterior is a bony crust, usually furnished with movable spines, by which they are defended from injury, and by means of which they have their progressive motion; these are often very numerous, amounting in some species to upwards of two thousand. The mouth is placed beneath, and in most of the species has five valves or teeth.

The common sea urchin, which lodges in cavities of rocks just within low-water mark, on most of the British coasts, is nearly of a globular shape, having its shell marked into ten partitions or divisions, not much unlike those of an orange. The mouth is situated in the lower or under part, and armed with five strong and sharpened teeth. The stomach and intestines, which are of consi-

Manner of moving—Tenacious of life.

derable length, are disposed in a somewhat circular form, and the whole body is supported entirely by a set of upright bones or columns. On the outside of the shell is a prodigious number of sharp movable spines, of a dull violet and greenish color, curiously articulated, like ball or socket, with tubercles on the surface, and connected by strong ligaments to the skin or epidermis with which the shell is covered. The spines are the instruments by which the animal conveys itself at pleasure from one place to another; and by means of these it is enabled to move at the bottom of the water with great swiftness. It generally employs those about the mouth for this purpose, keeping that opening downward; but it is also asserted to have the power of moving forward by turning on itself like a wheel. When any thing alarms these animals, they immediately move all their spines toward it, and wait an attack, as an army of pikemen would with their weapons. The number of muscles, fibres, and other apparatus necessary to the proper management of these must be very great, and are exceedingly wonderful. So tenacious are the sea urchins of the vital principle, that, on opening one of them, it is no uncommon circumstance to observe the several parts of the broken shell move off in different directions. The ancients, according to Oppian, believed that if they were even cut up with knives, and the mangled parts thrown into the

sea, the respective parts would immediately join, and the animal be restored to life again.

There are, between the spines, and disposed in a continued longitudinal series on the several divisions or regions of the shell, an infinite number of very small foramina, communicating with an equal number of tentacula placed above them. These are the instruments by which the creature affixes itself to any object, and stops its motions. They are possessed of a very high degree of contractile power, and are furnished at the extremities with an expansile part, which may be supposed to operate as a sphincter, or as the tail of a leech, in fastening the animals securely to rocks and other substances to which they choose to adhere.

The shell of this animal, when deprived of the spines, which often fall off after its death, is of a pale reddish tinge, and the tubercles on which the spines are fixed appear like so many pearly protuberances on the surface.

These animals were used by the Romans, who dressed it with mead, parsley, mint, and vinegar. At Marseilles, and in some other towns on the continent, this species is exposed for sale in the markets as oysters are with us, and is eaten boiled like an egg. It forms an article of food among the lower class of people on the sea coasts of many parts of this country, but does not seem to have made its way to the tables of the opulent.

THE FATHER LASHER.

THE head of this fish is armed with very strong and extremely sharp spines, the largest of which are situated on the hind part, and the smallest before. The mouth is large, and the jaws, as well as the roof of the mouth, are beset with very sharp teeth. The body suddenly tapers towards the tail, and instead of scales it is covered with small sharp-pointed scuta, which render it rough to the touch; these scuta, or excrescences, are much smaller in the female than in the male. The belly is large, and white in the female; in the male it is yellow, variegated with white. In the latter, the pectoral fins are much larger than in the former, so that the two sexes may easily be distinguished at first sight. The rays of the ventral fins are striped in the female with black and white, but in the male they are of a red flesh color and spotted with white.

The father lasher is an inhabitant of the Baltic and Northern seas, particularly on the coasts of Greenland, Newfoundland, and Siberia; it is likewise found in the Mediterranean sea. In southern latitudes it is scarcely a foot in length, but in the Norwegian seas we are informed by Pontoppidan, that it sometimes measures two fathoms. It usually keeps at the bottom, and appears on the surface of the water only when pressed by hunger and in quest of food. It swims with great rapidity by means of its large

Rapacious disposition—Easily taken.

pectoral fins. When first caught, if held in the hand, it makes a strong and peculiar sound by the expulsion of air through its mouth. During this action the mouth is opened to the utmost width, the fins are extended, and the whole body is agitated with a tremulous motion.

In summer the father lasher repairs to the coasts, but in winter keeps in the deep waters. It is bold, but its voracity renders it imprudent, so that it may be easily taken with a line. It is of such a rapacious disposition as even to attack fish much larger than itself, and pursues in particular young salmon and herrings. It is frequently taken with torsk and other sea fish, which it follows into the nets. The season for spawning is December and January, and it deposits its eggs among sea weed.

This fish is not eaten in some countries, from an idea that its flesh is of a venomous quality. This opinion, doubtless, originates from the danger which in certain cases attends a wound with its spines. In Denmark it is reckoned difficult of digestion, and is used as food only by the poor. In Norway nothing but the liver is used, and from this an oil is extracted. The Greenlanders, however, esteem it as food, and give it to the sick as a very wholesome nourishment. They eat it boiled, dried, and sometimes even raw; they are likewise very fond of its eggs.

Several species—Gemmeous dragonet.

THE DRAGONET.

THERE are several species of this fish, all of which have their eyes vertical approximated; their gill-covers shut, with a small aperture on each side the neck; the gill-membrane six-rayed; the body naked; and the ventral fins very remote. They inhabit the North sea, the Mediterranean, and Indian seas; belong to the class of voracious fish, and seldom exceed a foot in length.

The gemmeous dragonet is distinguished by the extraordinary length of the first ray of the first dorsal fin, which is equal to that of the whole body. The head is oblong, broad, arched above, and flat below; the mouth wide, and the teeth small and numerous. The body is of a tapering form, smooth, and free from visible scales; the pectoral and ventral fins are of a remarkably thin and delicate texture, they are large and of a round figure. The dorsal fin is of a triangular form, having seldom more than four or five rays, the first of which extends far beyond the rest.

According to the descriptions of various naturalists, we find that, like most other fish, the dragonet varies considerably in color in different individuals. Those caught in the Mediterranean are sometimes spotted with brown and blue, and

Where found, and how caught.

sometimes with red; and, according to the fishermen, the males are distinguished by a variety of colors, while the females are confined to two, brown and red. When in full perfection, however, this fish generally corresponds with Mr. Pennant's description; the pupils of the eyes being rich sapphirine blue; the irides, fine fiery carbuncle; the pectoral fins light brown; the side line straight; the colors of the fish yellow, blue, and white, making a beautiful appearance when fresh taken; the blue is of an inexpressible splendor, the richest cœrulean, glowing with a gemmeous brilliancy; and the throat black.

The gemmeous dragonet is found in the Mediterranean, in the British seas, and German ocean. It grows to the length of twelve or fourteen inches; its flesh is white, and of a good flavor. The season for catching it is summer. It is caught by net, and in North America at the same time with the herring. Muller asserts, that it lives upon small leeches, and *stellæ marinæ*.

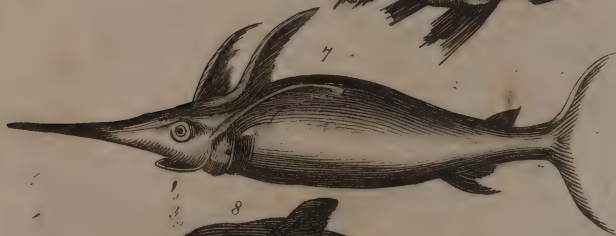
We are told by Pontoppidan, who, as he never saw the dragonet alive, was, no doubt, misinformed, that these fish raise themselves in troops some yards above the surface of the sea, and that they can fly the distance of several gun-shots. But the pectoral and ventral fins are too small, in comparison with those of other flying fish, to enable the dragonet to support itself for any length of time in the air.

The head of the sordid dragonet, which, from its strong resemblance to the gemmeous dragonet, has been by some considered the same species, is considerably more arched than that of the latter, and the first ray of the dorsal fin of the sordid dragonet is only as long as the head of the fish. In the sordid that fin is blackish, and in the gemmeous dragonet it is spotted with yellow and blue. The latter is twelve or fourteen inches in length, but the former never exceeds eight inches, and its colors are less varied.

"The first dorsal fin of this fish," says Mr. Pennant, "has four rays, the first setaceous, extending a little higher than the others; the last very short; the two first rays and webs yellow, the others black; the second had ten soft rays, their ends extending beyond the webs, which were pellucid; the pectoral fins consisted of twenty rays, and were ferruginous, spotted with a deeper cast of the same; the ventral fins consisted of five broad and much branched rays, like those of the first species; the anal fin was white, and had ten rays; the tail had ten rays, bifurcated at their ends, and the ray next the anal fin very short. In color this species is far inferior to the former, being of a dirty yellow mixed with white dusky spots; the belly is entirely white. Müller asserts, that it is cinereous, and the tail fin yellow, in some instances adorned with two black stripes.

Where found.

According to Linnæus, the sordid dragonet is found near Rome, Genoa, and Lisbon; Pennant places it among the British, and Müller among the Danish fish, and Duhamel discovered it on the coasts of Normandy. By the French fishermen it is supposed to be the female of the gemmeous dragonet.



SHELL FISH, &c.

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CHAP. XI.

"The prickly star creeps on with full deceit,
To force the *oyster* from his close retreat."

JONES'S OPPIAN.

THE OYSTER.

OYSTERS are bivalve shell fish, having the valves generally unequal. The hinge is without teeth, but furnished with a somewhat oval cavity, and mostly with lateral transverse grooves. They adhere to rocks, or, as in two or three species, to roots of trees on the shore.

These shell fish are formed with organs of life and respiration, with intestines which are very voluminous, a liver, lungs, and heart. They are self-impregnated, and the shells, which they soon acquire, and to which they are strongly attached both above and below, serve them for their future habitation. Oysters breathe by means of gills; they draw the water in at their mouth, a small opening in the upper part of the body, drive it down a long canal that constitute the base of the gills, and so out again, retaining the air for the necessary functions of the body.

Edible oyster—Spawning time.

The edible oysters inhabit the European and Indian seas, and are well known as a palatable and nutritious food. Most of our coasts produce them in great abundance, but the coasts chiefly celebrated are those of Essex and Suffolk. Here they are dredged up by means of a net, with an iron scraper at the mouth, that is dragged by a rope from a boat, over the beds. As soon as taken from their native beds, they are stored in pits formed for the purpose, furnished with sluices, through which, at the spring tides, the water is suffered to flow. This water being stagnant, soon becomes green in warm weather, and, in a few days afterward, the oysters acquire the same tinge, which renders them of greater value in the market; but they do not acquire their full quality, and become fit for sale, till the end of six or eight weeks.

Oysters usually cast their spawn, or spats, as the fishermen call them, in April or May, upon rocks, stones, shells, or any other hard substance that happens to be near the place where they lie, to which the spats immediately adhere. These, till they obtain their film or crust, are somewhat like a drop of a candle, but are of a greenish hue. The substances to which they adhere, of whatever nature, are called cultch. From the spawning time till about the end of July, the oysters are said to be sick, but by the end of August they become perfectly recovered. During these months they are out of season, and are

bad eating. This is known, on inspection, by the male having a black and the female a milky substance in the gill.

Oysters are not reckoned proper for the table till they are about a year and half old; so that the brood of one spring are not to be taken for sale till at least the September twelve months afterward. When younger than these happen to be caught in the dredge, they are always thrown into the sea again. The fishermen know the age of oysters by the broader distances or interstices among the rounds or rings of the convex shell.

The oysters in the pits of course always lie loose, but on their native beds they are in general fixed (from the time they are cast) by their under shell; and their goodness is said to be materially affected by their being laid in the pits with the flat shell downward, not being able in this position to retain sufficient water in the shell for their support.

It is asserted by the French, but apparently without proof, that the English oysters, which are esteemed the best in Europe, were originally procured from Concalles Bay, near St. Malo.

The oyster fishery of our principal coasts is regulated by a court of admiralty. In the month of May the fishermen are allowed to take the oysters, in order to separate the spawn from the cultch, the latter of which is thrown in again to preserve the bed for the future. After this

month it is felony to carry away the cultch, and otherwise punishable to take any oyster between whose shells, when closed, a shilling will rattle. The reason of the heavy penalty on destroying the cultch is, that when this is taken away, the ouse will increase, and muscles and cockles will breed on the bed and destroy the oysters, from gradually occupying all the places on which the spawn should be cast. There is likewise some penalty for not treading on and killing, or throwing on shore any star fish that happen to be seen. These, when collected in any numbers, are very destructive to the oyster beds, inserting their rays, as the shells lie open, and devouring the animals within.

The Abbé Dicquemaire, who attended minutely the manner of these as well as of several other marine animals, assures us that they have a power of moving themselves, and this by the singular effort of ejecting water with considerable force from their shells. They thus are able either to throw themselves backward or to start aside in a lateral direction. He says that any person may amuse himself with the squirting and motions of oysters, by putting them in a plate placed in a horizontal position, which contains as much sea water as is sufficient to cover them.

The oyster has been represented by many authors as an animal destitute not only of locomotive faculty, but of every species of sensation. The above naturalist, however, has shown that it can

Pearl oysters and pearl fisheries.

perform movements perfectly consonant to its wants, to the danger it apprehends, and to the enemies by which it is attacked. Instead of being destitute of sensation, oysters are even capable of deriving some knowledge from experience. When removed from situations that are constantly covered with the sea, from want of experience they open their shells, lose their water, and die in a few days; but, when taken from similar situations, and laid down in places from which the sea occasionally retires, they feel the effect of the sun's rays, or of the cold air, or perhaps apprehend the attacks of enemies, and accordingly learn to keep their shells close till the tide returns.

All oysters, and most shell fish, are found to contain pearls; but that which particularly obtains the name of the pearl oyster, has a large strong whitish shell, wrinkled and rough without, and within smooth, and of a silver color. From these the mother of pearl is taken, which is nothing more than the internal coats of the shell resembling the pearl in color and consistence. This, however, is of very little value, compared with the pearl itself, for the obtaining of which there are several places called pearl fisheries, both in Asia and America; those of the latter place have indeed gone much of late into disuse; and the principal one now in Asia is in the Persian Gulph, near the isle of Bahren; "where," says Goldsmith, "the wretched people that are

Dr. Goldsmith's remarks

destined to fish for pearls, are either negroes, or some of the poorest of the natives of Persia. The divers are not only subject to the dangers of the deep, to tempests, to suffocation at the bottom, to being devoured by sharks, but from their profession universally labor under a spitting of blood, occasioned by the pressure of air upon their lungs in going down to the bottom. The most robust and healthy young men are chosen for this employment, but they seldom survive it five or six years. Their fibres become rigid, their eye-balls turn red, and they usually die consumptive. It is amazing how long they are seen to continue at the bottom. Some, as we are assured, have been known to continue three quarters of an hour under water without breathing, and to one unused to diving, ten minutes would suffocate the strongest. They fish for pearls, or rather the oysters that contain them, in boats twenty-eight feet long; and of these are sometimes three or four hundred at a time, with each seven or eight stones, which serve for anchors. There are from five to eight divers belonging to each, that dive one after another. They are quite naked, except that they have a net hanging down from the neck to put their oysters in, and gloves on their hands to defend them while they pick the oysters from the holes in the rocks, for in this manner alone can they be gathered. Every diver is sunk by means of a stone, weighing fifty pounds, tied to the rope by

On the pearl fishery.

which he descends. He places his foot in a kind of stirrup, and laying hold of the rope with his left hand, with his right he stops his nose to keep in his breath, as in going down he takes in a very long inspiration. When at the bottom, they give a signal to those in the boat to draw up the stone, which done, they go to work, filling their net as fast as they can; and then giving another signal, the boats above pull up the net loaded with oysters, and shortly after the diver himself, to take a new inspiration. All the oysters are brought on shore, where they are laid in a great heap till the pearl fishery is over, which continues during the months of November and December."

The fishing season being over, they then examine every oyster for the pearls; but they are not always alike successful, for some seasons turn out infinitely more advantageous than others, not entirely arising from the numbers they obtain, but from their value, which increases not only in proportion to their size, but also in their figure and color; some are found of an oblong, others nearly round; some are white, others have a yellowish shade; others are of a led color, and some, though vere rarely, are met with as black as jet.

SCALLOPS.

THE scallop has the power of progressive motion upon land, and likewise of swimming on the surface of the water. When this animal happens to be deserted by the tide, it opens its shell to the full extent, then shuts it with a sudden jerk, by which it often rises five or six inches from the ground: in this manner it tumbles forward till it regains the water. When the sea is calm, troops or little fleets of scallops are often swimming on the surface. They raise one valve of their shell above the surface, which becomes a kind of sail, while the other remains on the water, and answers the purpose of a keel by steadying the animal, and thus preventing its being overset. When an enemy approaches they instantly shut their shells, plunge to the bottom, and the whole fleet disappears. By what means they are enabled to regain the surface cannot be ascertained.

MUSCLES.

THIS tribe is distinguished by the shell being bivalve, without any tooth in the hinge, but in having the hinge marked with a longitudinal hollow line, and by the animal being generally fixed to some substance by a byssus, or silky

beard. Some of the muscles penetrate into the interior of calcareous rocks, where they reside out of the reach of danger. Others adhere by their beard to the exterior of rocks or stones; and so very tenacious is their hold, that, in the larger species, they cannot be separated without considerable exertion. One species is gathered from the depths of the sea, by divers trained for the purpose, on account of the pearls that are found within the shells. Of these the ancient Romans were extravagantly fond.

All the muscles have, for an instrument of motion, a tongue or foot capable of considerable elongation, and also of being shortened into the form of a heart. This is marked with a longitudinal furrow, and completely enveloped in a sheath formed of transverse and circular fibres of an obscure purple color. When the animal feels inclined to change its place, it thrusts the foot out of the shell, and raises itself on its edge; then, by reaching this to as great a distance as it will extend, it uses it as a kind of arm, drawing the body up to it, and thus it proceeds till it has found a convenient situation. If the muscle be inclined to make this its residence, the instrument of its motion is now put to a very different employment, in spinning those silky threads that fix it firmly to the spot; and, like a ship at anchor, enables it to brave all the agitations of the water. This it accomplishes by seizing with its

Common, or edible muscle.

point the gluten supplied by a gland situated under its base, and drawing out, through the furrow, into threads. When the muscle is thus fixed, it lives upon the little earthy particles, or upon the bodies of such smaller animals as the water transports to its shells.

The common, or edible muscle, is found adhering to rocks both in the European and Indian seas, but it grows to a much greater size between the tropics than northward. It abounds on the British shores, being the most common of shell fish, and is generally esteemed a rich and wholesome food; but to some constitutions it often occasions disorders, the symptoms of which are great swellings, eruptions of blotches or pimples, shortness of breath, convulsive motions, and sometimes even delirium. This unwholesome quality has been attributed to a small species of crab that sometimes is found in the shells of the muscle. It seems, however, not to have its seat in any thing essential to the muscle; for, when accidents of this kind have happened, some persons have been affected, and others have not, who have eaten at the same time, and at least in equal quantity. The following remedy is recommended for any illness occasioned by eating muscles. Take two spoons-full of oil, and one of lemon juice, (or, in want of this, about two of vinegar,) which must be well shaken together, and swallowed as soon as any of the symptoms take place.

Pearl muscle—Description.

The pearl muscle has a flattened and nearly orbicular shell, about eight inches long, and somewhat more in breadth. The color of the exterior is very various, being in some individuals sea-green, in others chesnut, or even bloom color, with white rays, and sometimes whitish with green rays. The young shells resemble scallops, having ears as long as the shell. The pearl is a calculus, or morbid concretion, which is produced not only in this, but sometimes even in the common oysters and muscles; but in these it is generally very small, and of little value. It is found both in the body of the animal and in the shells on the outside of the body. For particulars relative to the fishery for pearls, see our account of *Oysters*.

*THE PAPER NAUTILUS, or ARGO-
NAUT.*

THIS species, which is six or eight inches in length, and but little either thicker or stronger than paper, is found in the Mediterranean sea, and in the Indian ocean. It is the famous nautilus of the ancients, and is supposed, in the early ages of society, to have furnished the original idea of navigation. When it means to sail, it discharges a quantity of water from its shell, by which it is rendered lighter than the surrounding medium, and of course rises to the

Mode of sailing—Extraordinary sagacity.

surface. Here it extends two of its arms upward, which are each furnished at their extremity with an oval membrane that serves as a sail. The other six arms hang over the sides of the shell, and supply the place either of oars or rudder.

Multitudes of these curious animals may be sometimes seen in some places, when the sea is not agitated by winds, diverting themselves by sailing about in this manner; but as soon as a storm rises, or any thing gives them disturbance, they retract their arms, take in as much water as renders them somewhat heavier than that in which they swim, and then sink to the bottom. Several of them were observed by M. Le Vaillant on the sea near the Cape of Good Hope; and, as he was desirous of obtaining perfect specimens of the shells, he sent some of his people into the water to catch them; but, when the men had got their hands within a certain distance, they always instantly sank, and, with all the art that could be employed, they were not able to lay hold of a single one. The instinct of the animal showed itself superior to all their subtilty; and, when their disappointed master called them away from their attempts, they expressed themselves not a little chagrined at being outwitted by a shell fish.

The shell of all this tribe is univalve, spiral, involute, and membranaceous, with only a single cell.

Chambered, or pearly nautilus—Common, and goose bernacles.

The chambered, or pearly nautilus, belongs to a different tribe, and bears very little resemblance to the paper nautilus, (which, as before remarked, is the real nautilus of the ancients,) either in its construction or habits. This animal, if seen detached from its shell, might be mistaken for an eight-armed cuttle fish, the principal difference consisting only in the shape of those arms that are used as sails.

BERNACLES.

THE two shells of this tribe that are best known are the common bernacle, which is found adhering in vast numbers to rocks, and to oysters and other shell fish, and the goose bernacle, so well known from the fables of its producing the bernacle goose. (See vol. iii. p. 230.) The animals contained in these shells, (which are fixed at the base, and consist of more than two unequal and erect valves,) as well as in those of all the other species, have twenty-four claws or tentacula, all joined in pairs near the bottom, and inserted in one common base. The twelve longest stand somewhat erect and arched, arising from the back part of the animal; they appear like so many yellow curled feathers, clear, horny, and articulated; every joint is furnished with two rows of hair on the concave side. They are

Claws, trunk or proboscis, mouth, &c.

of use in catching prey, and the animals are continually extending and contracting these arched hairy claws, which serve as a net. The twelve smallest are placed, six on each side, in front of these: they are more pliable and more thickly set with hairs than the others, and seem to perform the office of hands. The trunk, or proboscis, rises from the middle of the base of the larger claws, and is longer than any of them. This the animal moves with great agility in any direction; it is tubular, transparent, and composed of rings lessening gradually to the extremity, where it is surrounded with a circle of small bristles, which are likewise movable. Along the inside of this transparent proboscis appears the spiral dark-colored tongue, which is extended and contracted at pleasure. The mouth, formed not unlike a contracted purse, is placed in front between the smaller claws, within the folds of which are six or eight horny laminae, or erect teeth; under this lie the stomach, intestines, and tendons, by which the animal adheres to the shell.

The goose bernacles consist each of five shells. They adhere in clusters to the bottoms of vessels and old timber, by means of tubes that in appearance are like some of the corallines. See vol. iii. p. 230—232.

General description.

THE PHOLAS.

THE animal herein contained is called an ascidia, and has a shell of two valves, that open widely at each end, with several lesser ones at the hinge. The hinges are folded back, and united by a cartilage; and in the inside, beneath the hinge, there is an incurved tooth.

The pholades perforate clay, spongy stones, and wood, while very young; and, as they increase in size, they enlarge their habitation within, and thus become imprisoned. They are always found below high-water mark, and a mass of rock may sometimes be seen wholly perforated by them. They have two orifices or openings capable of elongation in the manner of a proboscis; one of these is supposed to be the mouth, and has the faculty of spouting water. Most of them contain a phosphorescent liquor, of great brilliancy in the dark, which also illuminates whatever it touches or happens to fall upon.

THE DACTYLE PHOLAS.

THIS species has an oblong shell, marked with somewhat spinous stripes. When full grown it is about an inch and a quarter long, and near five inches broad. It is of a whitish color, and,

Extraordinary powers of penetration.

in external appearance, has a distant resemblance to a muscle. It is found in the greatest quantity at Ancona in Italy; also along the shores of Normandy and Poitou in France, and upon some of the coasts of Scotland. It is highly admired by the luxurious, who esteem it a great delicacy.

The great powers of penetration of these animals, compared with their apparent imbecility, have justly excited the astonishment of philosophers and naturalists in all ages. When divested of their shell they are roundish and soft, with no instrument that seems in the least fitted for boring into stones, which they are known to do, or even for penetrating the softest substance. They are, indeed, each furnished with two teeth, but these are placed in such a situation as to be incapable of touching the hollow surface of their stony dwellings. They have also two corners to their shells that open and shut at either end; but these are totally unserviceable to them as miners. The instrument with which they perform all their operations, and by means of which they bury themselves in the hardest rocks, is only a broad fleshy substance, somewhat resembling a tongue, that is seen issuing from the bottom of the shell. With this soft yielding instrument, while yet young and small, they work their way into the substance of the stone, and they enlarge their apartment as their increasing size renders it expedient.

Its uncommon perseverance and patience.

Many philosophers, however, have been induced to suppose, from the apparent unfitness of this animal for penetrating into rocks, and there forming a habitation, that they entered the rock while it was yet in a soft state, and, from the petrifying quality of the water, that the whole rock afterward hardened round them by degrees. This opinion, however, has been confuted in a very satisfactory manner by Dr. Bohads, who observed that many of the pillars of the temple of Serapis at Puteoli were penetrated by these animals; whence he justly concludes that the pholades must have pierced into them after they were erected; for no workman would have labored a pillar into form, if it had been honey-combed by worms in the quarry. In short, there can be no doubt but that the pillars were perfectly sound when erected, and that these animals attacked them during the time in which they continued buried under water, from the earthquake that swallowed up the city.

Hence the pholades afford a wonderful instance of perseverance and patience. Furnished with the bluntest and softest augre, by slow successive applications, it effects what other animals are incapable of performing by force, penetrating the hardest bodies only with its tongue. When, while yet very small, it has effected an entrance and buried its body in the stone, it there continues for life at its ease; the sea water that enters at the little aperture supplying it with

Slow motion—Immured state.

luxurious plenty. Upon this seemingly thin diet it by degrees grows larger and larger, and soon finds itself under the necessity of increasing the dimensions of its habitation and its shell.

The motion of the animal is remarkably slow; its progress keeps pace with the growth of its body; and, in proportion as it becomes larger, it makes its way farther into the rock. When it has got a certain way in, it then turns from its former direction and hollows downward; till, at last, when its habitation is completed, the whole apartment resembles the bowl of a tobacco-pipe; the hole in the shank being that by which the animal entered. Thus immured, it lives in darkness, indolence, and plenty; it never removes from the narrow mansion into which it has penetrated, and seems perfectly content with being inclosed in its own sepulchre.

Notwithstanding the pholas is thus shut up, it is not so solitary as might naturally be supposed, for though it is immured in its hole, without egress, when grown to a great size, and incapable to get out by the way it made to get in, yet many of this kind often meet in the heart of the rock, and sometimes above twenty are discovered within a few inches of each other.

THE RAZOR FISH.

THE shells of these fish are bivalve, oblong, in shape somewhat resembling the handle of a razor, and open at both ends. The hinge has a small and sharp reflected tooth, sometimes double, not inserted into the opposite valve. The animals are similar to the pholades.

Several of the bivalved shell fish have the power of performing a progressive or retrograde motion, by an instrument that has some resemblance to a leg or foot, and called the tongue; but the razor fish can, at pleasure, make this assume almost every kind of form, as their exigences require. By this tongue they are not only enabled to creep, to sink into the mud, or disengage themselves from it, but to perform a motion which no one could suppose was practicable for shell fish.

All the species of razor fish are incapable of progressive motion on the surface; but they dig a hole or cell in the sand, sometimes two feet in depth, in which they can ascend or descend at pleasure. The instrument, or tongue, by which they perform all their motions, is situated at the centre. It is fleshy, cylindrical, and tolerably long. When necessary, the animals can make the termination of the tongue assume the form of a ball. The razor fish, when lying on the surface of the sand, and about to sink into it,

extends its tongue from the inferior end of the shell, and makes the extremity of it take the form of a shovel, sharp on each side, and terminating in a point: with this instrument the animal cuts a hole in the sand. After the hole is made, it advances the tongue still farther into the sand, makes it assume the form of a hook, and with this hook, as a fulcrum, it obliges the shell to descend into the hole. In this manner the animal operates till the shell totally disappears. When it chuses to regain the surface, it puts the termination of the tongue into the shape of a ball, and makes an effort to extend the whole tongue, but the ball prevents any farther descent, and the muscular effort necessarily pushes the shell upward till it reaches the surface or top of the hole. It is amazing with what dexterity and quickness these seemingly awkward motions are performed.

Notwithstanding the razor fish lives in salt water, it has a most remarkable aversion to salt. Should a little be thrown into the hole, the animal instantly quits its habitation. But it is still more remarkable, that if the animal be once seized with the hand, and afterwards allowed to retire into its cell, salt will then be strewed in vain, for the fish will never again make its appearance. If it be not handled, by applying salt the animal may be made to come to the surface as often as a person pleases, and fishermen often make use of this stratagem. This

Description.

conduct indicates more sagacity than could be expected from an animal of this low order.

CRABS.

CRABS have in general eight legs, (some, however, have six or ten,) besides two large claws, which serve the purposes of hands. They have two eyes, situated on tubercles projecting from the head, and movable in any direction. When the extremities of these are viewed with a glass, they are found to be composed of a multitude of lenses, like the eyes of insects. For a sense of touch they are furnished with antennæ, and palpi, or feelers. They have likewise a heart, with arterial and veinous vessels, and branchiæ, or gills for respiration. Their jaws are transverse, strong, and numerous; and the stomach is furnished with internal teeth.

These animals regularly cast their shell once a year. This is a process that occupies some time, and seems to be attended with much pain. During the operation, and for a little while afterward, their skins are soft, in consequence of which multitudes of them are devoured by aquatic animals, now stronger than themselves. At this time those calcareous concretions, vulgarly called crab's eyes, are found in their stomachs. When any of the claws are broken off they are reproduced.

General food—Manners.

Crabs live chiefly in the sea; some, however, inhabit the fresh water, and a few live in a great measure on land. They feed variously on aquatic or marine plants, small fish, molluscæ, or dead bodies. The females carry their ova under their tail, which, for that purpose, in many of the species, is much broader than that of the males.

The land, or violet crabs, are natives of the Bahamas, and of most of the other islands between the tropics. They are in shape somewhat like the black-clawed crab, and the largest measures about six inches from the body. They vary in color, but are commonly of a blackish violet; some are entirely black, others red, and others variegated. They are distinguished from other species of crabs by having the joint of the leg spinous, and the second or third furnished with tufts of hair.

Some are poisonous; and several people have died of eating the crabs, particularly of the black kind. The light-colored are reckoned best, and when in full flesh, are very well tasted. In some of the sugar islands they are eat without danger, and no small help to the negro slaves, who, on many of these islands, would fare very badly without them.

These crabs live in the clefts of rocks, the hollows of trees, or in holes which they dig for themselves in the mountains. About the months of April and May in every year, they descend in

Regularity of their processions.

a body of some millions at a time to the sea-coast, in order to deposit their spawn, and at this season the whole ground seems alive with them. They march in a direct line to their place of destination, and are said seldom to turn out of their way on account of intervening obstacles; even if they meet with a lofty wall or a house, they will attempt to scale it; if they arrive at a river, they wind along the course of the stream. In their procession they are generally divided into three battalions, and observe all the regularity of an army under the guidance of an experienced commander. The first of these consists of the strongest males, which march forward to clear the route, and face the greatest dangers. The main body is composed of females, which are sometimes formed into column fifty or sixty yards broad, and three miles deep. The first division is often obliged to halt from want of rain, and the females never come from the mountains till the rains have set in for some time. Three or four days after these, the rear-guard follows, a straggling undisciplined tribe, consisting of males and females, but neither so robust nor so vigorous as the former.

Their marches take place chiefly in the night, but if it rain during the day, they always profit by it. When the sun is hot they invariably halt till the evening. When terrified they run back in a confused and disorderly manner, holding up and clattering their nippers with a threatening atti

Preparations for spawning.

tude; and if they are suffered to catch hold of the hand they will sometimes tear off a piece of the skin. If in their journey any one of their body is so maimed as to be incapable of proceeding, some of them always fall upon and devour it. They march very slowly, being sometimes three months or upward in gaining the shore.

On their arrival at the coast they prepare to cast their spawn; for which purpose they go to the edge of the water, and suffer the waves to wash twice or thrice over their bodies. They then withdraw to seek a lodging upon land. In the mean time the spawn is excluded in a bunch from the body, and adheres to the under parts of the tail. This bunch becomes as large as a hen's egg, and exactly resembles the roe of a herring. In this state they again, for the last time, seek the shore, and shaking off the spawn into the water, leave it to the waters, and the heat of the sun, to be brought to maturity. About two thirds of the eggs are devoured by the shoals of fish which annually frequent the shores in expectation of this prey. Those that escape are hatched under the sand; and, not long after this, millions of the little crabs may be seen quitting the shore, and slowly travelling up to the mountains.

On their return the old ones are feeble, lean, and so inactive, that they are scarcely able to crawl along, and their flesh at this time changes

Curious operation of casting their shells.

its color. Many of them are obliged to continue in the level parts of the country till they recover, making holes in the earth which they block up with leaves and dirt. In these they cast their old shells, which they leave, as it were, quite whole, the place where they opened on the belly being unseen: at that time they are quite naked, and almost without motion for six days together, when they become so fat as to be delicious food. They have then under their stomachs four large white stones, which gradually decrease in proportion as the shell hardens, and, when they come to perfection, are not to be found. It is at that time that the animal is seen slowly making its way back; and all this is most commonly performed in the space of six weeks.

These crabs subsist on vegetables, and, except when impelled by the desire of bringing forth their young, seldom venture from their mountainous retreats. At this season the inhabitants of the islands where they are found wait in eager expectation for their descent, and destroy some thousands of them; they disregard the bodies, and take only the spawn that lies on each side of the stomach within the shell, about the thickness of a man's thumb. The animals are much more valuable for eating on their return, after they have cast their shells. They are taken in the holes; and also sought for by night, when on their journey, by flambeaux. The instant the crabs perceive themselves attacked,

How caught—Dr. Darwin's remarks.

they throw themselves on their back, and with their claws pinch most dreadfully whatever they happen to fasten on; but the dextrous crab-catcher seizes them by the hinder legs in such a manner that the nippers cannot touch him. They are also caught in their holes by the sea side, by so fixing a stick as to prevent their escaping, and soon afterwards the tide enters the holes, and the animals are drowned. Wafer says that the inhabitants of some of the Caribbee islands, when they have caught them, put them for three days into a piece of potatoe ground, in order to render them more firm, and better eating.

The black-clawed, or eatable crab, is found on the rocky coasts both of Europe and India; and is the same that is introduced to our tables, being in greater esteem as food than many others of the tribe. These animals are remarkable for their changing their shells and broken claws. The former is done once a year, and that usually between Christmas and Easter. During the operation they retire among the cavities of rocks and under great stones; and Dr. Darwin says, (from the authority of a friend who had been engaged in surveying the sea coasts,) that a hard-shelled crab always stands sentinel to prevent the sea insects from injuring the rest in their defenceless state; and that, from his appearance, the fishermen know where to find the soft ones, which they use for baits in catching fish; adding that,

though the hard-shelled crab, when he is on his duty, advances boldly to meet the foe, and will with difficulty quit the field, yet at other times he shews great timidity, and is very expeditious in effecting his escape; if, however, he be often interrupted, he will pretend death, like the spider, and watch an opportunity to sink himself into the sand, keeping only his eyes above. In the under part of the shell a crescent-formed suture may be observed, which opens at the casting of the shell, and leaves a space sufficient for drawing out the whole body; the thorax soon after drops its breast-plate, and then the legs quit their crustaceous coverings. The body is now only enveloped in a soft skin, not unlike wet parchment; and the animal is so helpless, as for a while to be incapable of motion, but lies between the rocks till it has acquired sufficient strength and hardness to bear the weight of its body, and convey itself from place to place to perform its usual functions. The old shell is left in two divisions, one that covered the body, and the other that inclosed the legs. Dr. Darwin asserts that the stomach and intestines are also cast with the skin, and that the first food the animal takes after recovering its strength is the old stomach. It sometimes happens that the shell hardens prematurely, and fixes the animal a prisoner in his crevice, for fishermen have often found them thus immured. When crabs are out of health they do not change their shells.

regularly, the old shells always remaining till they have recovered their proper strength and vigor.

The fishermen, when they take a crab that is not in good condition, return it to the sea, and sometimes mark it on the back with a sharp-pointed instrument, or the end of a knife; and it is very surprising that this mark may not only be seen to remain on the old shell, but that it is also found impressed on the subsequent new one. These men also say that, when crabs have had their shells marked, and been carried out to the distance of two or three miles, and thrown among others, they will always find their way back again: this the men have often observed by catching them in their former haunts.

These animals are naturally very quarrelsome, and frequently have serious contests by means of those formidable weapons, their great claws. With these they lay hold of their adversary's legs, and wherever they seize it is not easy to make them forego their hold. They frequently retain some part of the leg or limb as a token of victory.

In order to prove the extreme tenacious disposition of the crab, a fisherman, in the presence of Mr. Collinson made, by irritation, a crab seize one of its own small claws with a large one. The foolish creature did not distinguish that it was itself the aggressor, but exerted its strength, and soon cracked the shell of the small claw. Feeling

itself wounded, it cast off the piece in the usual place, but continued to retain the hold with the great claw for a long time afterward.

It is asserted by fishermen that the crab will live confined in a pot or basket for several months, without any other food than what is collected from the sea water, and that even in this situation it will not decrease in weight.

The hermit, or soldier crab, another species, is usually about four inches long. It has no shell behind, but is covered down to the tail with a rough skin, terminating in a point. It is armed with two strong hard nippers before, one of which is as thick as a man's thumb, and so strong as to be capable of inflicting a very severe wound. Having no shell to any part but its nippers, this animal supplies by art what is denied to it by nature; for, taking possession of the deserted shell of some other animal, it occupies that till, by becoming too large for its habitation, it is under the necessity of changing it.

It is highly entertaining to observe this animal in some countries busily parading the sea shore, along that line of pebbles and shells which is formed by the farthest wave; still, however, dragging its old incommodious habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can meet with another more convenient. It stops first at one shell, turns it, passes by; then goes to another, contemplates that for a while, and, slipping its

Mutual combats—Sand crab.

tail from the old habitation, tries on the new. This also is found inconvenient, and it quickly resumes the old one. In this manner it frequently changes, till at length it finds one light, roomy, and commodious. To this it adheres, though the shell be sometimes so large as to hide both the creature's body and claws.

Many trials and combats, however, are sometimes sustained by this crab, before he is thus completely equipped; for there is often a contest between two of them for some favorite shell, to which they are rivals. They both endeavor to take possession; striking with their claw, and biting each other till the weakest is compelled to yield. The victor then takes possession, and in his new acquisition parades backward and forward on the strand before his envious antagonist.

This animal, whenever caught, emits a faint cry, but pinches forcibly with its claws; nor is there any mode of getting disengaged from these but by either breaking them off or heating the shell. It feeds on fish and insects. It is called the hermit, from the idea of its retiring into a cell; and the soldier, from its dwelling in a tent.

The sand-crab is but of a small size; its color light brown or dusky white. It has eight legs and two claws, one of which is double the size of the other: these claws serve both to defend and feed themselves with. The head has two

Red-mottled crab—Rough-shelled crab.

square holes, which are receptacles for its eyes, out of which it thrusts them and draws them in again at pleasure. Their abode is only on the sandy shores of Flathera, and many other of the Bahama islands. They run very fast, and retreat from danger into little holes they make in the sand.

The red mottled crab has a round body; the legs longer and larger than in other kinds; the claws red, except which, the whole is mottled in a beautiful manner with red and white. These crabs inhabit the rocks hanging over the sea; they are the nimblest of all others, and run with surprising agility along the upright side of a rock, and even under the rocks that hang horizontally below the water. This they are often necessitated to do for escaping the assaults of rapacious birds that pursue them. These crabs never go to land, but frequent mostly those parts of the promontories and islands of rocks in and near the sea, where by the continual and violent agitation of the waves against the rocks they are always wet, continually receiving the spray of the sea, which often washes them into it; but they instantly return to the rock again, not being able to live under water, and yet requiring more of that element than any of the crustaceous kinds that are not fish.

The rough-shelled crabs are pretty large, and are commonly taken from the bottom of the sea

The red-clawed, pea, and common crabs.

in shallow water; the legs are small in proportion to the body; the two claws are remarkably large and flat. The whole shell is covered over with innumerable little tubercles like shagreen; the color is brown, variously stained with purple.

The red-clawed crab is of a small size and brown color; it has two claws of unequal bigness, red at the ends, and eight legs, which seem of less use to them than in other crabs, for when on the ground they crawl with a slow pace, dragging their bodies along; but they are mostly seen grasping with their claws, and hanging to some sea plant, or other marine substance.

The pea crab has a round, smooth thorax, entire and blunt; its tail is of the size of the body, which commonly is the bulk of a pea. It inhabits the muscle, and has unjustly acquired the repute of being poisonous. The swelling after eating of muscles is wholly constitutional; for one that is affected by it, hundreds remain uninjured. Crabs either of this kind, or allied to them, the ancients believed to have been the consentaneous inmates of the pinna, and other bivalves, which being too stupid to perceive the approach of their prey, were warned of it by their vigilant friend.

The common crab has three notches on the front; five serrated teeth on each side; the claws elevated; the next joint toothed; the hind feet subulated; the color a dirty green, but red when

Velvet crab—Horrid crab.

boiled. It inhabits all our shores, and lurks under the algæ, or burrows under the sand. It is sold, and eaten by the poor of our capitals.

The velvet crab has the thorax quinquedentated; the body is covered with short, brown, velvet-like pile, and the claws with minute tubercles; there are small spines round the top of the second joint; the hind legs are broadly ovated. This is among the species taken notice of by Aristotle on account of the broad feet, which, he says, assist them in swimming, as web feet do the water fowl. It inhabits the western coast of Anglesea.

The horrid crab has a projecting, bifurcated snout, the end diverging; the body is heart-shaped; and the claws and legs covered with long and very sharp spines. It is a large species, and inhabits the rocks on the eastern coasts of Scotland.

LOBSTERS.

THE common lobster has a smooth thorax, short serrated snout, very long antennæ, and between them two shorter ones; bifid claws, and fangs large, the greater tuberculated, the lesser serrated on the inner edge; four pair of legs, six joints in the tail; tail-fins rounded. The pincers of one of the lobster's large claws are furnished with knobs, and those

Annual operation of casting their shells.

of the other are always serrated. With the former it keeps firm hold of the stalks of submarine plants, and with the latter it cuts and minces its food very dexterously. The knobbed, or numb claw, as the fishermen call it, is sometimes on the right, and sometimes on the left side indifferently. It is more dangerous to be seized by them with the cutting claw than the other; but, in either case, the quickest way to get disengaged from the creature is to pull off its claw.

Like the rest of their tribe, they annually cast their shells. Previously to their putting off the old one, they appear sick, languid, and restless. They acquire an entirely new covering in a few days; but during the time that they remain defenceless they seek some lonely place, lest they should be attacked and devoured by such of their brethren as are not in the same weak situation. At the same time that they cast their shell they change also their stomach and intestines.

In casting their shells, it is difficult to conceive how the lobsters are able to draw the fish of their large claws out, leaving the shells of these entire, and attached to the shell of their body, in which state they are constantly found. The fishermen say that, previously to the operation, the lobster pines away till the fish in its large claw is no thicker than the quill of a goose, which enables it to draw its parts through the joints and narrow passage near the trunk. The new shell is membranaceous at first, but it har-

How and where caught—Extremely prolific.

dens by degrees. Lobsters only grow in size while their shells are in their soft state.

These animals are found on most of the rocky coasts of Great Britain. Some are caught with the hand, but the greater quantity in pots; a sort of trap formed of twigs, and baited with garbage. These are formed like a wire mouse-trap, so that when the lobster gets in, there is no return. They are fastened to a cord sunk into the sea, and their place is marked by a buoy. They are caught in such plenty on the coast of Northumberland, that, about the year 1769, the sum paid for the annual exports from Newbiggin and Newton by the sea, (exclusive of those from Holy Island, which produce annually a very considerable sum,) amounted to near 1500*l*. This circumstance was stated by John Creswell, Esq. of Creswell, who for many years had made the payments for them from one fishmonger in London, on whose account all the most valuable fish from the coast of Northumberland were shipped.

Lobsters are extremely prolific; Dr. Baster counted 12,444 eggs under the tail of a female lobster, besides those that remained in the body unprotruded. They deposit these eggs in the sand, where they are soon hatched. The female, or hen lobster, does not cast her shell the same year that she deposits her ova, or, in the common phrase, is in berry. When the ova first appear under her tail, they are small, and

Of the ova when deposited.

extremely black; but they come in succession, almost as large as ripe elder-berries before they are deposited, and turn of a dark brown color, especially towards the end of the time of her depositing them. They continue full, and depositing the ova in constant succession, as long as any of that black substance can be found in their body, which, when boiled, turns of a beautiful red color, and is called their coral. Hen-lobsters are found in berry at all times of the year, but chiefly in winter. It is a common mistake, that a berried hen is always in perfection for the table: when her berries appear large and brownish, she will always be found exhausted, watery, and poor. Though the ova be cast at all times of the year, they seem only to come to life during the warm summer months of July and August. Great numbers of them may then be found, under the appearance of tad-poles, swimming about the little pools left by the tide among the rocks, and many also under their proper form from half an inch to four inches in length.

Lobsters, like some of the crabs, are said to be attached to particular parts of the sea. They are able to run nimbly upon their legs or small claws in the water, and if alarmed they can spring, tail foremost, to a surprising distance, almost as swiftly as a bird can fly. The fishermen can see them pass about thirty feet, and, by the swiftness of their motion, it is supposed

Agility—Claws lost by sudden noise.

that they may go much farther. When frightened, they will spring from a considerable distance to their hold in the rock; and, what is not less surprising than true, will throw themselves into their hold in that manner, through an entrance barely sufficient for their bodies to pass, as is frequently seen by the people who endeavor to catch them at Filey Bridge, near Scarborough.

At thunder claps, or on the sound of cannon, lobsters absolutely lose their claws, and the fishermen are often jestingly threatened with a salute by the sailors. The restoration of claws thus lost may always be observed, for these never again grow to their former size. When the claws of lobsters become inconvenient from being by any means injured, they always break them off.

However different in figure the lobster and crab may seem, their manners and conformation are nearly the same. Though devoid of red blood circulating through their veins, or any warmth in their bodies, they possess all the voracity of the finny tribe, and whatever they seize upon, that has life, is sure to perish, though ever so well defended; they even devour each other, and in some measure may be said to feed upon themselves, as the old stomach which they cast upon changing their shell is generally the first morsel that serves to glut the new.

As soon as the offspring of these creatures leave their parents, they immediately seek for

Manners of young lobsters.

refuge in the smallest clefts of rocks, and in such like crevices at the bottom of the sea, where the entrance is but small, and the opening can be easily defended. There, without seeming to take any food, they grow larger in a few weeks time, from the mere accidental substances which the water washes to their retreats. By this time also they acquire an hard, firm shell, which furnishes them with both offensive and defensive armour; they then begin to issue from their fortresses, and boldly creep along the bottom in hopes of meeting with more diminutive plunder: the spawn of fish, the smaller animals of their own species, but chiefly the worms that keep at the bottom of the sea, supply them with plenty. They keep in this manner close among the rocks, busily employed in scratching up the sand for worms, or surprising such heedless animals as fall within their reach, and leading a life of security, except from each other; for, like other fish, the largest are the most formidable of all enemies to the small.

The operation of changing the shell is not only very painful, but also very dangerous, for many of them die under it. For some days previous to the change the animal becomes torpid and motionless; just before casting its shell it throws itself upon its back, strikes its claws against each other, and every limb seems to tremble; its feelers are agitated, and the whole body in violent motion; it then swells to a great degree; the

State of imbecility when changing their shell.

shell opens first at the junctures of the belly, and by a similar operation it is discharged of its claws, and in a short time the creature is at liberty, but so weak that it continues for some time motionless, possessing the softness and timidity of a worm, and they fall a prey by hundreds to the dog fish, the cod, and the ray. This state of imbecility, however, remains for a short time, and when the lobster is completely equipped in its new shell, it will appear to have increased above a third in its size; and we are astonished how the deserted shell could have contained so large an animal as that which entirely fills up the new.

It is supposed, in order to account for the speedy growth of the shell, that the lobster possesses in itself a fluid of a petrifying quality; but this is, in fact, only explaining one mystery by another. Who can forbear exclaiming, in the words of Goldsmith, "let us pause a little, to reflect on the wonders this extraordinary creature offers to our imagination! an animal without bones on the inside, yet furnished with a stomach capable of digesting the hardest substances, the shells of muscles, of oysters, and even its own; an animal gaining a new stomach and a new shell at stated intervals; furnished with the instruments of generation double in both sexes, and yet with an apparent incapacity of uniting! Without red blood circulating through the body, and yet apparently vigorous and ac-

Plated lobster—Atam ditto.—Flea ditto.

tive! But most strange of all, an animal endowed with a vital principle that furnishes such limbs as have been cut away, and keeps continually combating, though in constant repair, to renew its engagements! Yet these are but a small part of the wonders of the deep, where Nature sports without a spectator."

The plated lobster has a pyramidal, spiny snout; the thorax elegantly plated, each plate being marked near its junction with short striæ; the claws much longer than the body, thick, echinated, and tuberculated; the upper fang trifid; only three spiny legs on their sides, and the tail broad. The largest of this species is about six inches long. It inhabits the coasts of Anglesea, under stones and fuci. It is very active, and, if taken, flaps its tail against the body with much violence and noise.

The atam lobster has a slender body; filiform antennæ; three pair of legs near the head, behind which are two pair of oval vesiculæ; beyond are three pair of legs, and a slender tail between the last pair. It is very minute, and the help of the microscope is often necessary for its inspection.

The flea lobster has five pair of legs, and two claws imperfect, with twelve joints of the body. It is very common in fountains and rivulets; swims very swiftly in an incurvated posture on its back; embraces and protects its young between its legs, but does not leap.

Description—Nutrimental in consumptions.

The locust lobster has four antennæ; two pair of imperfect claws, the first joint ovated; the body consists of fourteen joints, in which it differs from the former. It abounds in summer on the shores beneath stones and algæ, and leaps about with vast agility.

THE CRAW FISH,

ANOTHER species of lobsters, has a projecting snout, slightly serrated on the sides; a smooth thorax; the back is smooth, with two small spines on each side; the claws large, beset with small tubercles; the two first pair of legs clawed, the two next fubulated; the tail consists of five joints, and the caudal fins are rounded.

The flesh of the craw fish is cooling, moistening, and adapted to nourish such as labor under consumptions. Though they are variously dressed, yet no parts of them are eatable except their claws and tails. Soups are frequently made of them, which are rendered still more medicinal by the addition of herbs, snails, or other substances, according to the intention of the physician. The flesh is accounted best in the summer months; but the delicate flavor of these fish depends in a great measure on their food. When they have well-tasted food, their flesh preserves the relish of it; but when they feed on other things, they are often rendered of no value

Where found—Various food.

by the flavor communicated to their flesh by them.

There are great quantities of these fish in the river Obra, on the borders of Silesia; but the people find them scarcely eatable, because of a bitter aromatic flavor, very disagreeable in food. It has lately been observed, that the *calamus aromaticus* grows in vast abundance on the banks of that river, and that these creatures feed very greedily upon its roots. These have a very remarkable bitterness mixed with their aromatic flavor, while fresh, which goes off very much in the drying; and on comparing the taste of these roots with that of the craw fish, there remains no doubt of the one being owing to the other.

They also abound in the river Don, in Muscovy, where they are laid in heaps to putrify, after which the stones called crabs eyes are picked out. These animals are very greedy of flesh, and flock in great numbers about carcasses thrown into the water where they are, and never leave them while any remains; they also feed on dead frogs when they come in their way. In Switzerland there are some craw fish which are red when they are alive, and others blueish. Some kinds of them also will never become red even by boiling, but continue blackish.

The craw fish discharges itself of its stomach, and, as Geoffrey thinks, of its intestines too. These, as they putrify and dissolve, serve for

food to the animal; during the time of the reformation, the old stomach seems to be the first food that the new one digests.

In the breaking of the claw of the common craw fish, it has been observed that, in about a day or two after the piece is cast off, a red membrane, not unlike a bit of red cloth, closes up the aperture. This is at first plain, but, in the course of four or five days, it assumes a convexity, which gradually augments till it takes the appearance of a small cone, of about a line in height. It continues, however, to stretch out, and in ten days it is sometimes more than three lines, or about a quarter of an inch high. It is not hollow, but filled with flesh, and this flesh is the basis or rudiment of a new claw. The membrane that covers the flesh performs the same office to the young claw as the membranes do the foetus of the larger animals. It extends in proportion as the animal grows; and, as it is tolerably thick, we can perceive nothing but a lengthened cone. When fifteen days are elapsed, this cone inclines toward the head of the animal. In a few days more its curvature increases, and it begins to assume the appearance of a dead claw. This claw, though at the end of a month or five weeks it has acquired the length of six or seven lines, which is more than half an inch, is still incapable of action. The membrane in which it is inclosed becoming gradually thinner in proportion as it extends, gives an opportunity

Extraordinary reproduction—How taken.

of observing the parts of the claw, and it is then plain that this conical substance is not a simple congeries of flesh. The moment is now arrived when the claw begins to be brought forth; the membrane at last bursts, and the new claw, though still soft, appears without incumbrance or investment. In a few days more it is covered with a shell, and, though still delicate, and not the half of its former length, it is able to perform all the natural functions. It has likewise been discovered that, whether the claw has been lopped off at the fourth articulation, or any where else, the animal in a short time recovers all that it had lost. The same reproduction takes place also in the horns; but, if the tail is cut off, the animal survives a few days only.

Craw fish are found in many of our rivers, lodged in holes which they form in the clayey banks; and their presence is generally esteemed an evidence of the goodness of the water. They are frequently taken by means of sticks split at the end, with a bait inserted in the cleft, and stuck in the mud at the distance of a few feet from each other. These sticks, after remaining some time, are taken up, generally with an animal adhering to each. They are gently drawn out of the mud, and a basket is put under them to receive the animals which always drop off when brought to the surface of the water.

THE PRAWN.

PRAWNS have a long serrated snout, bending upwards; three pair of very long filiform feelers; claws small, furnished with two fangs; smooth thorax; five joints to the tail; middle caudal fin subulated, two outmost flat and rounded. It is frequent in several shores among loose stones; sometimes found at sea, and taken on the surface over thirty fathoms depth of water; cinereous when fresh, and of a fine red when boiled.

THE SHRIMP.

SHRIMPS possess long slender feelers, and between them two projective laminae; the claws have a single-hooked movable fang; they have three pair of legs; seven joints in the tail; the middle caudal fin subulated, the four others round and fringed; a spine on the exterior side of each of the outmost. These animals inhabit the shores of Britain in vast quantities, and are the most delicious of the genus.

THE SQUILLA.

THIS has a snout like a prawn, but deeper and thinner; the feelers longer in proportion to

Turbinated shell fish.

the bulk ; the sub-caudal fins rather larger. This animal is, at full growth, not above the bulk of the shrimp.

The squilla inhabits the coast of Kent, and is sold in London under the name of the white shrimp, as it assumes that color when boiled.

SNAILS.

IN searching into the history of the turbinated shell fish, or those of the snail kind, we are naturally led to bring forward at the head of them the garden snail, as one whose peculiarities it has been more easy to develope, than those who are perfectly of a similar form and nature, but whose residence is chiefly at the bottom of the deep. Indeed these, as well as crabs, lobsters, shrimps, prawns, &c. are ranked as *insects* by our most celebrated naturalists ; but as such are by the fishmongers considered as fish, we have thought proper to conclude this volume with an account of shell fish in general.

The snail, to the mere transient observer, appears to be little more than a lump of inactive matter, loaded with a crustaceous covering, and totally insensible to all the objects with which it is surrounded ; but, upon a more close inspection, it will be found to be possessed of every faculty that can be possibly requisite for the life it is formed to lead ; that its organs of life are furnished in as ample a manner as are to be

Common and peculiar qualities.

found in any animal of the largest dimensions; that it has a tongue, brain, salival ducts, glands, nerves, stomach, and intestines; also liver, heart, and blood vessels, with a purple bag that supplies a red matter to different parts of the body, together with strong muscles that hold it to the shell, and which are hardened like tendons at their insertion. Thus far, it may be said to possess qualities in common with other animals; but, besides these, it has several peculiarities; the most striking of which is the having its eyes placed on the points of the largest horns. When the snail is in motion four horns are plainly seen, the two topmost considerably bigger than the others, and at the extremities of those are the two eyes, which appear like bright black spots; they are of a bulbous figure, have but one coat, and three humors which are common in the eyes of other animals, namely, the vitreous, aqueous, and crystalline, are in these very indistinctly seen. The animal possesses the power of directing its eyes to any object it will, and to preserve them from injury, can instantaneously contract them under the belly. Under the small horns is situated the mouth, and although the idea of teeth may appear inconsistent with an animal of such soft substance, it nevertheless possesses no less than eight, with which it is enabled to devour leaves, and many other substances seemingly harder than itself; indeed, upon particular occasions, it will even bite off pieces of its own

Both male and female—Young snails.

shell with them. The next peculiar quality is that of their being both male and female, and that while it impregnates another, is capable of being impregnated itself.

At the expiration of eighteen days they produce their eggs, which they hide with great caution and industry under the earth. These eggs are round, white, and covered with a soft shell; they produce them in very great numbers, and they are stuck together by a kind of slime, not in a thick bunch, but rather, as it has been said, like a bunch of grapes. On quitting the egg, the animal has a very small shell on its back, with only one convolution; this very soon enlarges, and the circles increase with the growth of the animal; never, however, exceeding four rounds and a half in the garden snail, though there are sea snails which sometimes have no less than ten. The first circle remains in its original state, and the animal always adds to the shell at the mouth which it increases as it grows in size, and until it is sufficiently large to contain its whole body.

Snails are possessed not only of a power of retreating into their shell, but of mending it when broken. Sometimes these animals are crushed seemingly to pieces, and to all appearance utterly destroyed; yet still they set themselves to work, and in a few days mend all their numerous breaches. The same substance by which the shell is originally made, goes to the

General food—Locomotive faculty—Tenacious of life.

re-establishment of the ruined habitation. The shell thus mended has a mottled appearance, all the new pieces being much whiter than the old fabric.

These animals are very voracious; they chiefly subsist upon the leaves of plants and trees, but are very delicate in their choice. At the approach of winter they bury themselves in the earth, or retire to some hole, to continue in a torpid state during the severity of the season.

Their locomotive faculty is by means of that broad muscular skin which commonly projects round the mouth of the shell; this they put out as far as they are able, and then, by a kind of contraction, draw the shell after; besides this, they have a great advantage from the slime with which they are so copiously furnished; this they constantly emit whenever they move, and which not only smooths their way, but enables them also to ascend or descend trees in search of food, or wherever their inclinations direct them.

These animals are remarkably tenacious of life; they have been known to revive after having lain in a cabinet *fifteen years*; and, what is more extraordinary, though a basin of them has been filled with boiling water, and when that was poured off the basin filled again with more hot water, the next morning they have been seen crawling about, some on the edge of the basin, some on the table, and others eating!

^A Water snails—Esculent snail.

There are about fifteen kinds of the sea snails, eight of the fresh water snail, and five of the land snail, all of which bear a strong resemblance to the garden snail. The water snails, however, both river or sea, are found in some things to differ very materially. In the first place, all snails which live in water are furnished by nature with a contrivance that enables them either to rise to the surface, or sink to the bottom of the water; this is performed by opening and shutting the orifice on the right side of the neck, which is supplied with muscles for that purpose. The snail sometimes gathers this aperture into an oblong tube, and stretches it above the surface of the water, in order to draw in or expel the water, as it finds occasion; by dilating it this animal rises, and by compressing it sinks to the bottom. Some are also found viviparous, while others lay eggs in the usual manner; and the former not only bring forth their young alive, but with their shells upon their backs; which, strange as it may appear, has been incontestibly proved by an experiment of Swammerdam.

Among the Romans the esculent snail constituted a favorite dish; but, according to Varro's account, who says that the shells of some of them would hold ten quarts, they had it of a size infinitely larger than any now known.

Description.—Enemy to all the shelly tribe.

THE TROCHUS,

WHICH is commonly considered of the snail species, has no mouth whatever, but simply a kind of trunk, which, in proportion to the size of the animal, is very long; this trunk is fleshy, muscular, supple, and hollow; its extremity is bordered with a cartilage, and toothed like a saw. These snails are a predatory species, and very justly been stated to be among the shelly tribe, what the tiger, eagle, and shark are to beasts, birds, and fish. The whole race of shelled animals, with every possible means, endeavor to avoid their approach, conscious, as it were, that whatever may be their size, their destruction is inevitable, as the strongest covering is not proof against the power of this rapacious enemy. The shell is very thick, and the animal very clumsily formed, yet it proceeds with greater swiftness than almost any other shell fish, seizing its prey with astonishing facility, and scarcely ever suffering the object it once has in pursuit to escape. Having once closed on the shell, however thick, it almost instantaneously penetrates with its augur-like trunk. Thus fixed, all efforts to escape on the part of the other is entirely useless; if it expand, and come to the surface, the trochus comes up also; and if it plunge to the bottom, the fell destroyer still maintains its hold.

Voracity.

In this manner it will adhere, until with its trunk it has sucked all the substance of the other fish, even for days and weeks ; nor ever quit its prey until it has so done, unless the other begins to putrify.

END OF VOL. V.

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